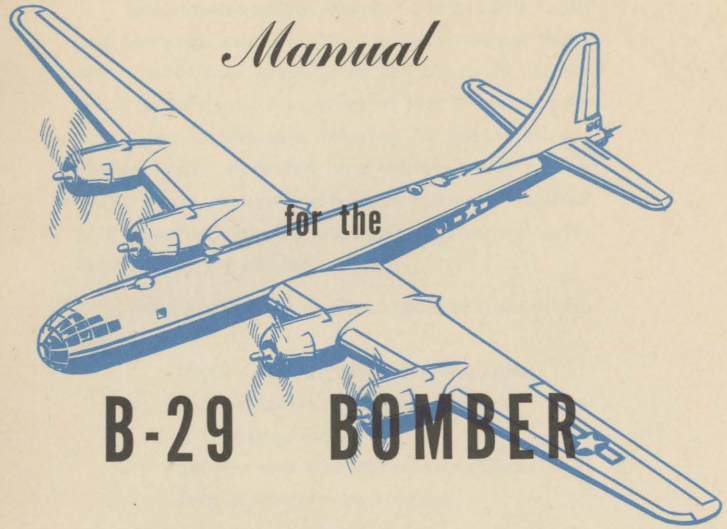
FLIGHT
AND OPERATIONAL
MANUAL

BOEING
B-29

RESTRICTED

Flight and Operational Manual



for the

B-29 BOMBER

DESIGNED BY

BOEING AIRCRAFT COMPANY

SEATTLE, WASHINGTON

RESTRICTED

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Published By Authority of the Commanding General, Army Air Forces,
By the Materiel Command Wright Field, Dayton, Ohio

FOREWORD

The purpose of this Manual is to provide rapid and thorough familiarization with the proper flight and operational procedures for the B-29 Heavy Bomber. It is one of a series of four manuals prepared for accelerated training of personnel assigned to the operation and maintenance of the B-29. These manuals should be carefully studied and observed by all personnel concerned with handling of the airplane.

The complete series of manuals consists of the following:

Flight and Operational Instructions.
Familiarization and Maintenance Instructions.
Service and Inspection Instructions.
Engine Change Instructions.

These manuals must not be confused with the B-29 Technical Orders. They are intended to supplement rather than replace the Technical Orders inasmuch as they are more suitable for accelerated training.

This manual has been prepared in permanent binding rather than loose leaf form to make it more compact, easier to handle and of a size convenient to be carried in the pocket. Revised reprints will be issued frequently to keep the information up to date.

Printed by
Craftsman Press
Seattle
U. S. A.

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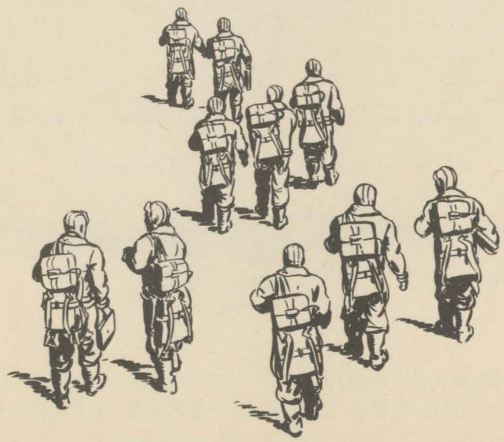
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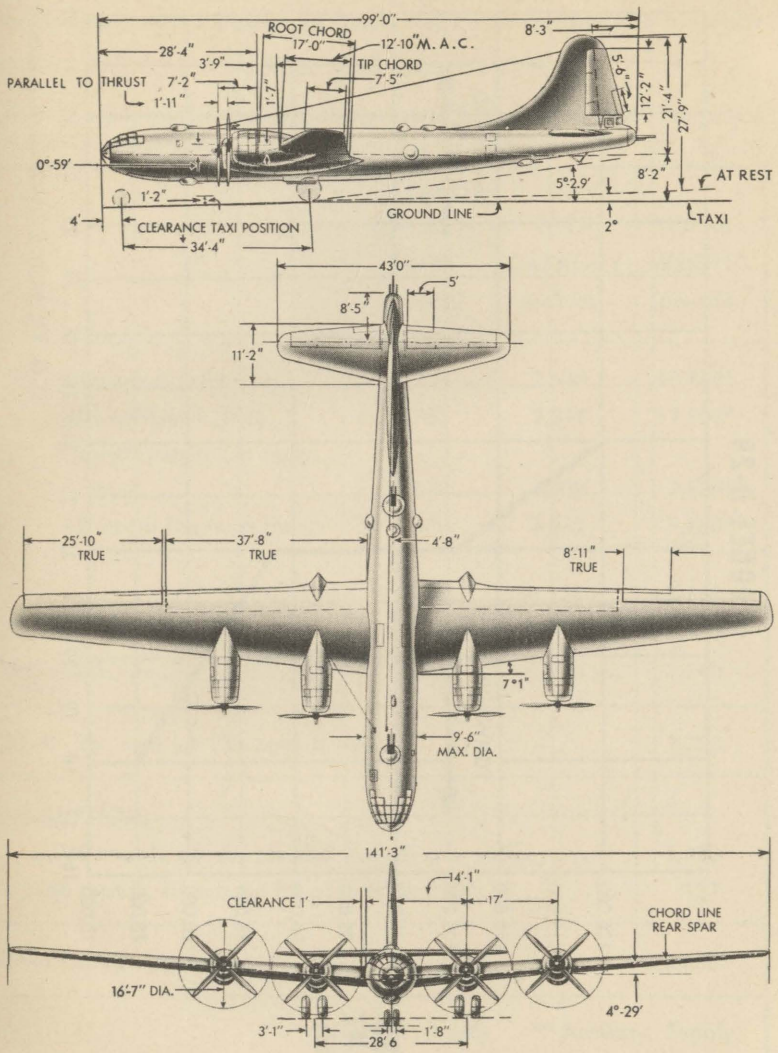
The information contained in this manual was the latest available in July, 1943. If any data is to be added or corrected, it is suggested that you incorporate such revisions in this book. Blank pages for your notes are provided.

Section 1

GENERAL INFORMATION

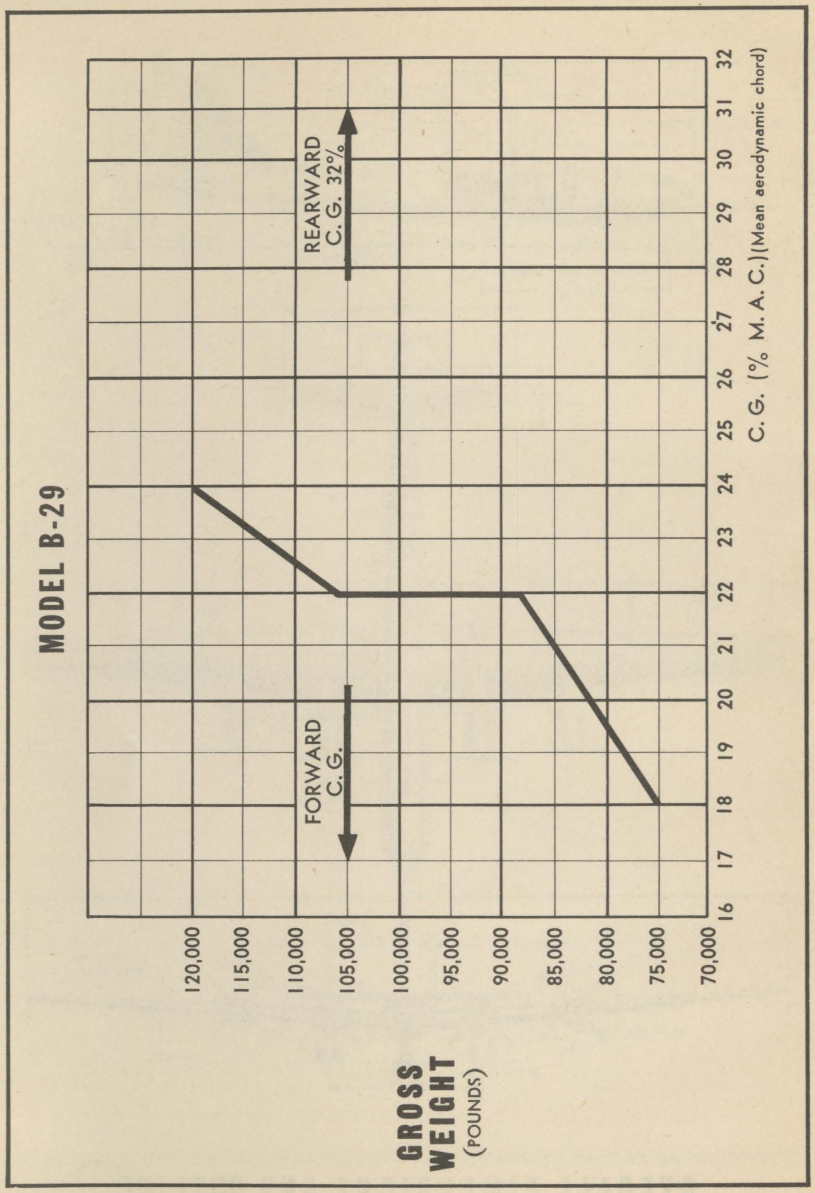






OVERALL DIMENSIONS AND OUTLINE

CENTER OF GRAVITY CHART



The locations of the centers of gravity for various loadings must not exceed the limits shown in this chart.

WEIGHT DATA

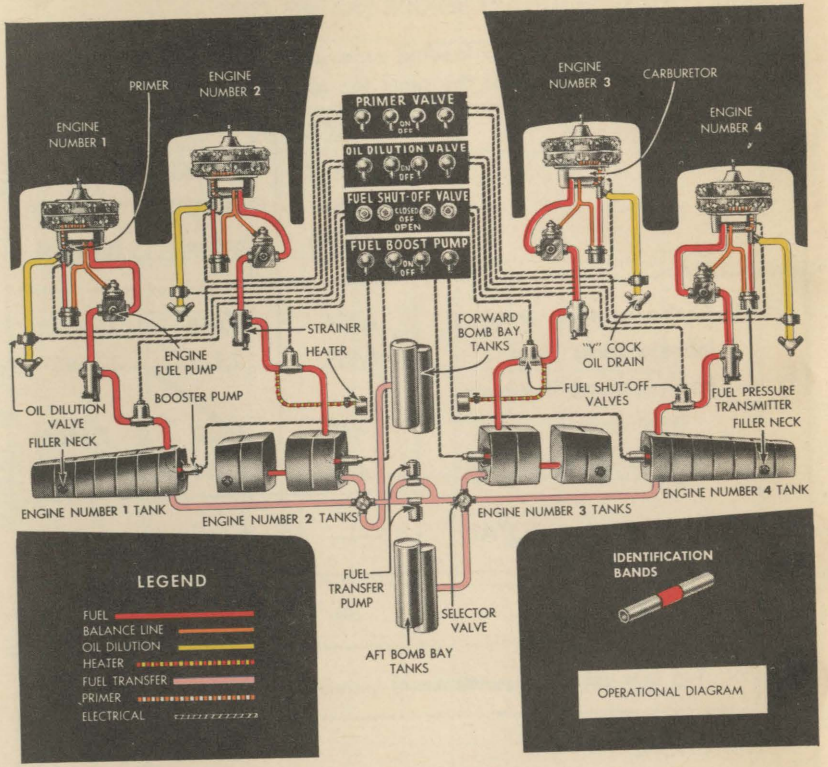
Complete weight data, and chart showing the location of the center of gravity of the airplane under various load conditions, are provided with each airplane.

CONSULT THE C. G. CHART BEFORE TAKING OFF.

Athough the permissible bomb loading varies between wide limits, the following maximum weights should be the same for all B-29 airplanes:

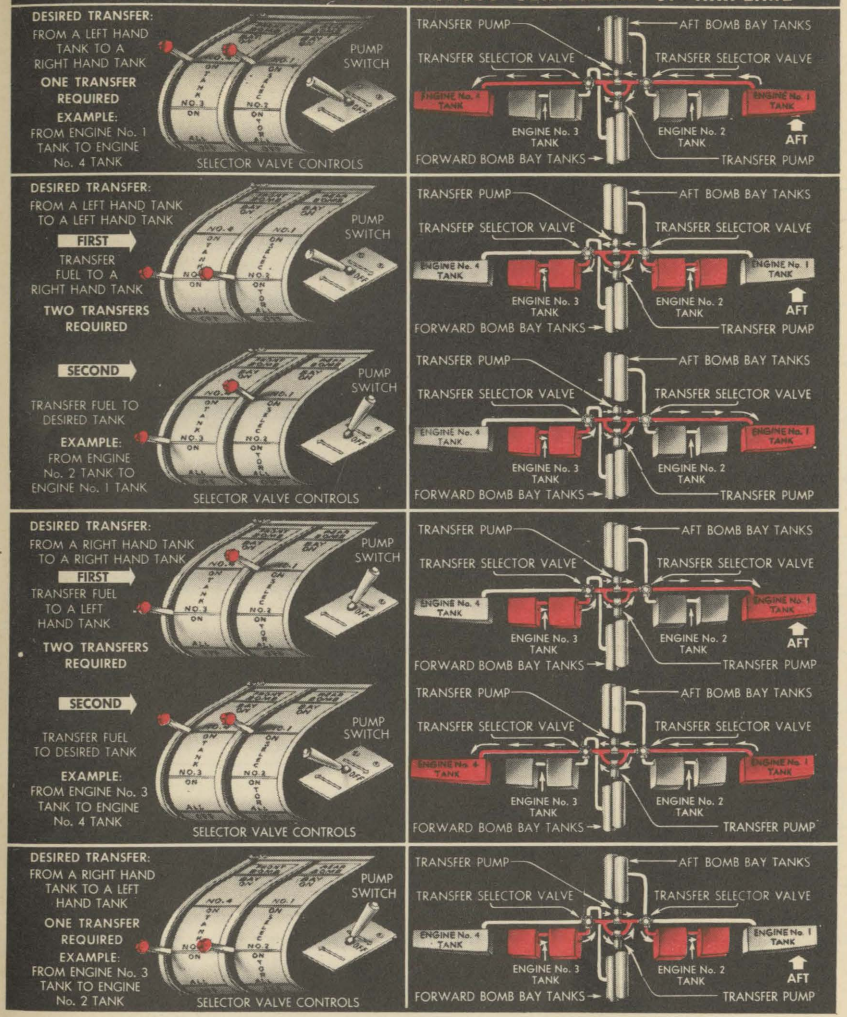
	CAPACITY OF EACH TANK (gallons)	TOTAL CAPACITY (gallons)	TOTAL WEIGHT (pounds)
FUEL: Outboard tanks (two)....	1,324	2,648	15,888*
Inboard tanks (two).....	1,459	2,918	17,508*
Forward bomb bay tanks (two)	640	1,280	7,680**
Aft bomb bay tanks (two)	640	1,280	7,680**
TOTAL	——	8,126	48,756
OIL: Tanks (four)	80	320	2,240
CREW: Ten men (at 235 pounds each)			2,350
AMMUNITION:			
6,000 rounds, 50 cal. (at 30.5 pounds per 100).....			1,830
250 rounds, 20 mm. (at 55 pounds per 100)			137
BOMB LOAD: (maximum)			20,000

* Normal Supply ** Auxiliary Supply



FUEL SYSTEM

ALL TRANSFERS MUST BE MADE ACROSS CENTERLINE OF AIRPLANE



FUEL TRANSFER DIAGRAM

Fuel will transfer at a rate of 27 gallons per minute.

NOTE: The flight engineer must notify the pilot of his intention to transfer fuel.

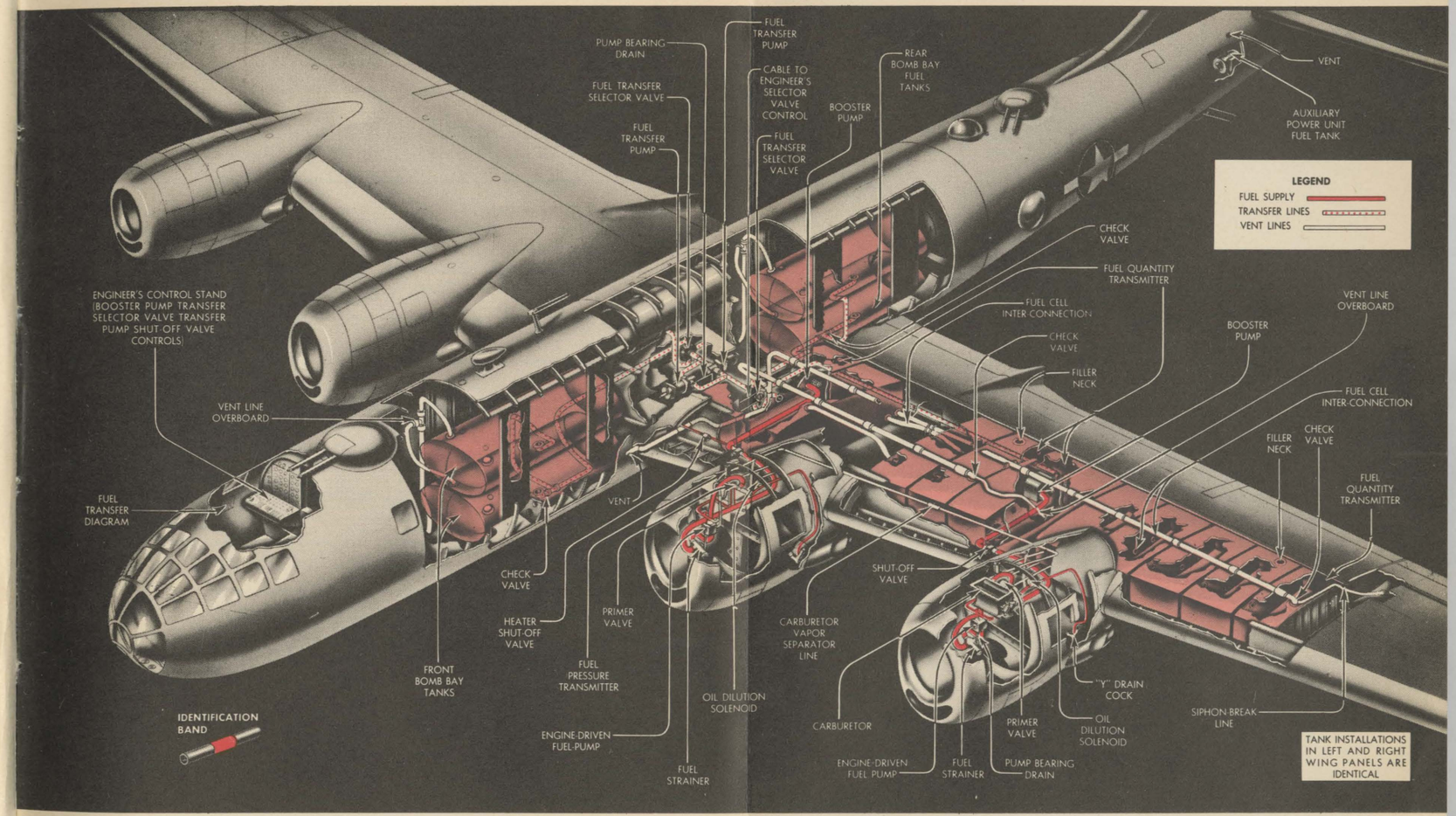
NOTES:

CONVERSION TABLE

1 U. S. GALLON equals .833 IMPERIAL GALLON
1 IMPERIAL GALLON equals 1.201 U. S. GALLON

FUEL TANK	GALLONS U. S.	GALLONS IMPERIAL
OUTBOARD	1324.	1104.
INBOARD	1459.	1215.
BOMB BAY	640.0	533.
AUXILIARY POWER PLANT	4.0	3.3

NOTES:



FUEL SYSTEM

NOTES:

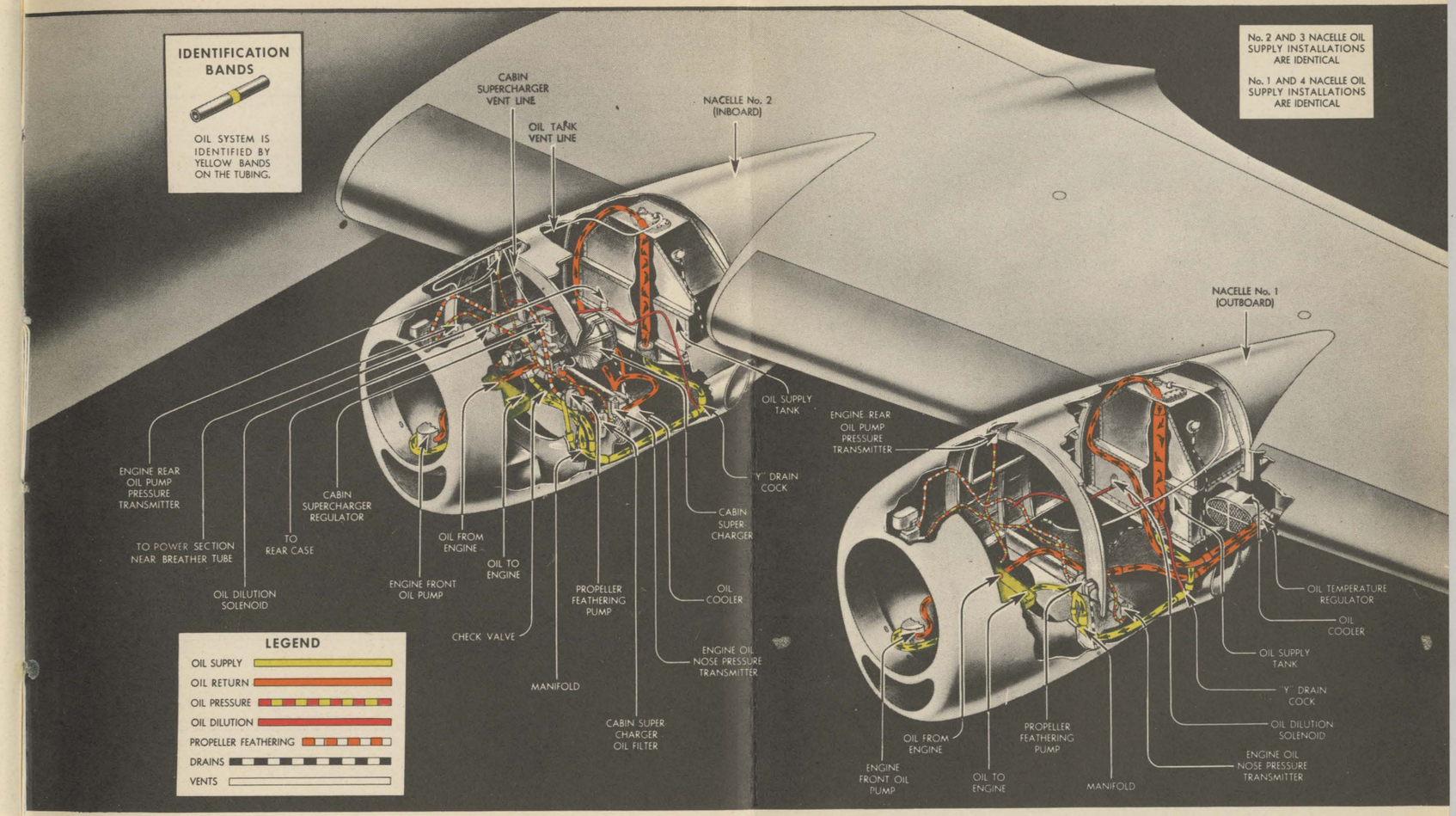
	GALLONS	
OIL TANK	U. S.	IMPERIAL
NACELLE	80.0	66.6
AUXILIARY POWER PLANT	1.0	.83

The oil tank for each engine is in the nacelle, with the filler neck opening on the outboard side near the top.

The auxiliary power plant oil system is entirely separate from that of the engines and is self contained.

LIFT FOR OIL SYSTEM (Page 11)

NOTES:



OIL SYSTEM

NOTES:

FLIGHT CREW

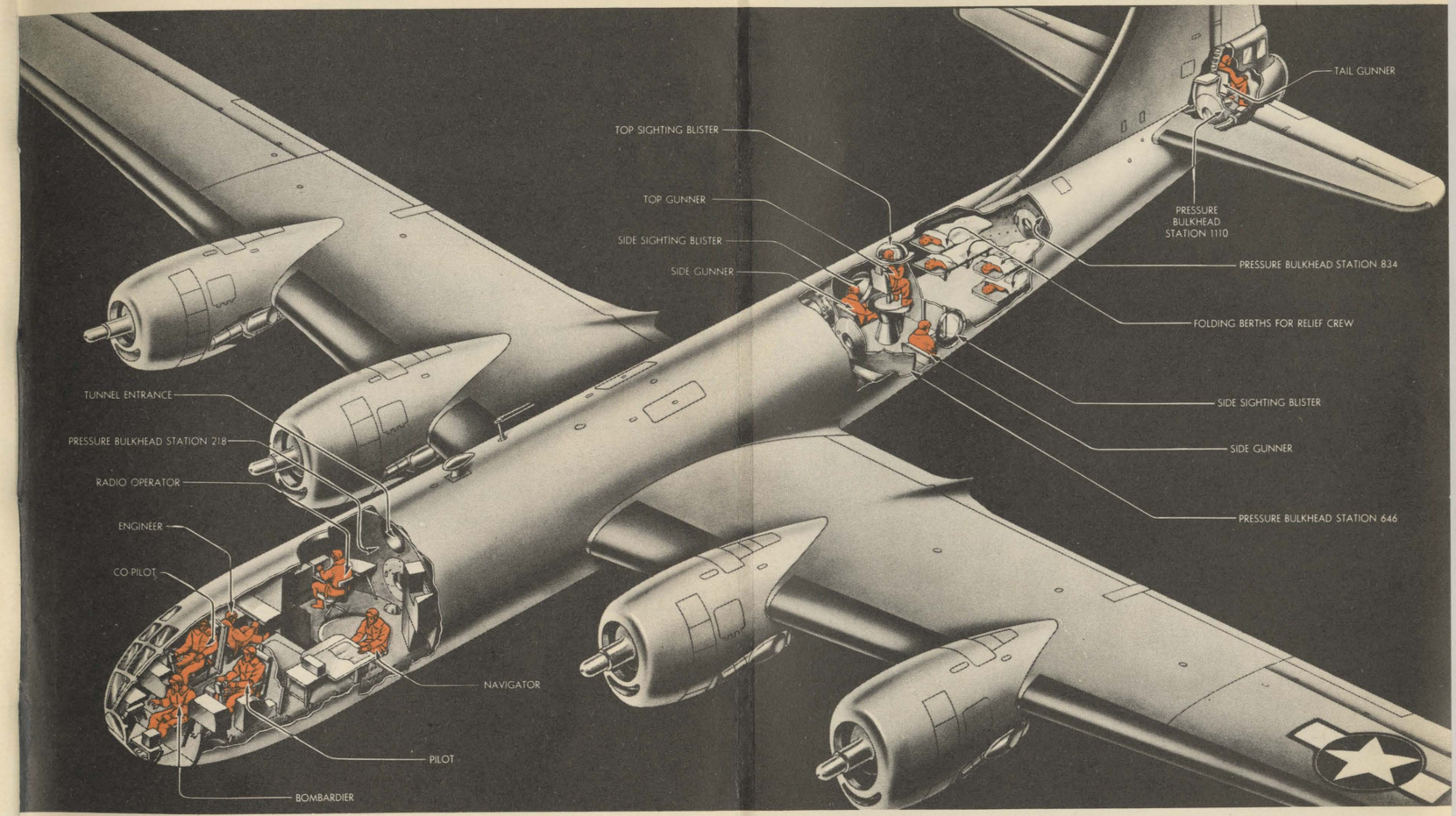
The normal flight crew of the B-29 consists of ten men. Allowance is made for carrying alternate numbers, but the normal complement consists of:

PILOT
CO-PILOT
FLIGHT ENGINEER
BOMBARDIER
NAVIGATOR
RADIO OPERATOR
SIDE GUNNERS (2)
TOP GUNNER
TAIL GUNNER

On the previous page a phantom view of the airplane shows the crew members in their proper positions.

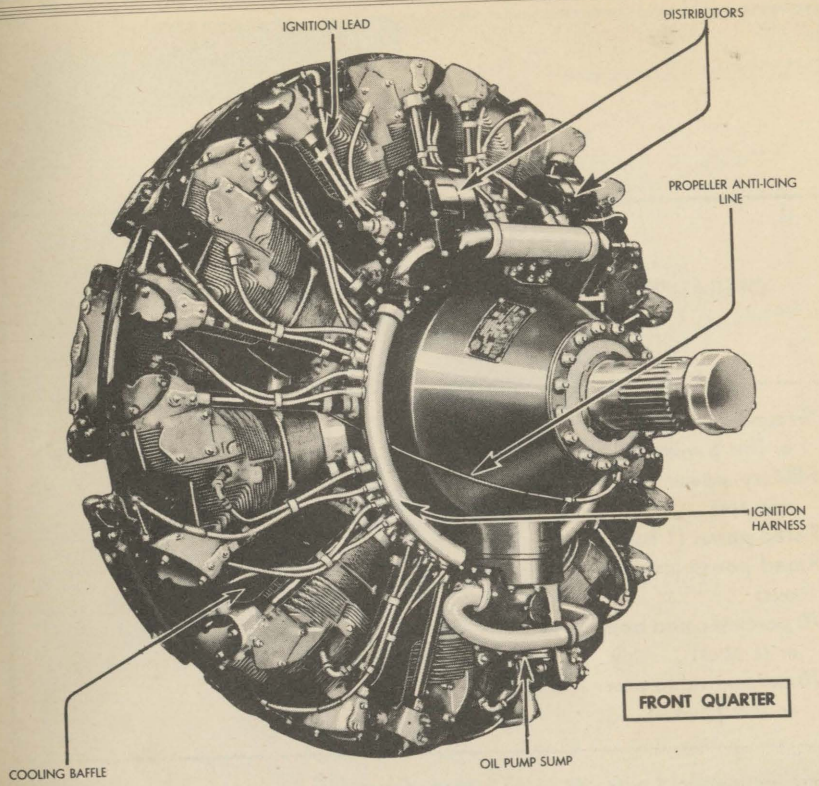
LIFT FOR CREW POSITIONS (Page 13)

NOTES:



CREW POSITIONS

NOTES:



Four Wright Model R-3350-21 engines are installed. The power rating of this engine is as follows:

TAKE-OFF POWER:

2200 H.P. at 2600 rpm at a manifold pressure of 47.5 inches of mercury.

MILITARY POWER:

2200 H.P. at 2600 rpm at a manifold pressure of 47.5 inches of mercury, at an altitude of 25,000 feet.

NORMAL RATED POWER:

2000 H. P. at 2400 rpm at sea level.

IDLING SPEED:

600 ± 50 rpm (propeller at increase rpm).

700

ENGINE

PERMISSIBLE MAXIMUM TEMPERATURE LIMITS FOR WRIGHT MODEL R-3350-21 ENGINES

OPERATION	CYLINDER HEAD TEMPERATURE (degrees Centigrade)	OIL IN TEMPERATURE (degrees Centigrade)	CARBURETOR AIR TEMPERATURE (degrees Centigrade)
Ground take-off power (for 5 minutes)....	260	95	30
Military power (for 5 minutes)	248	95	30
Rated power (1 hour)..	248	85	30
Rated power (continuous)	232	85	30
70 percent rated power (1 hour)	232	85	30
70 percent rated power (continuous).....	218	85	30

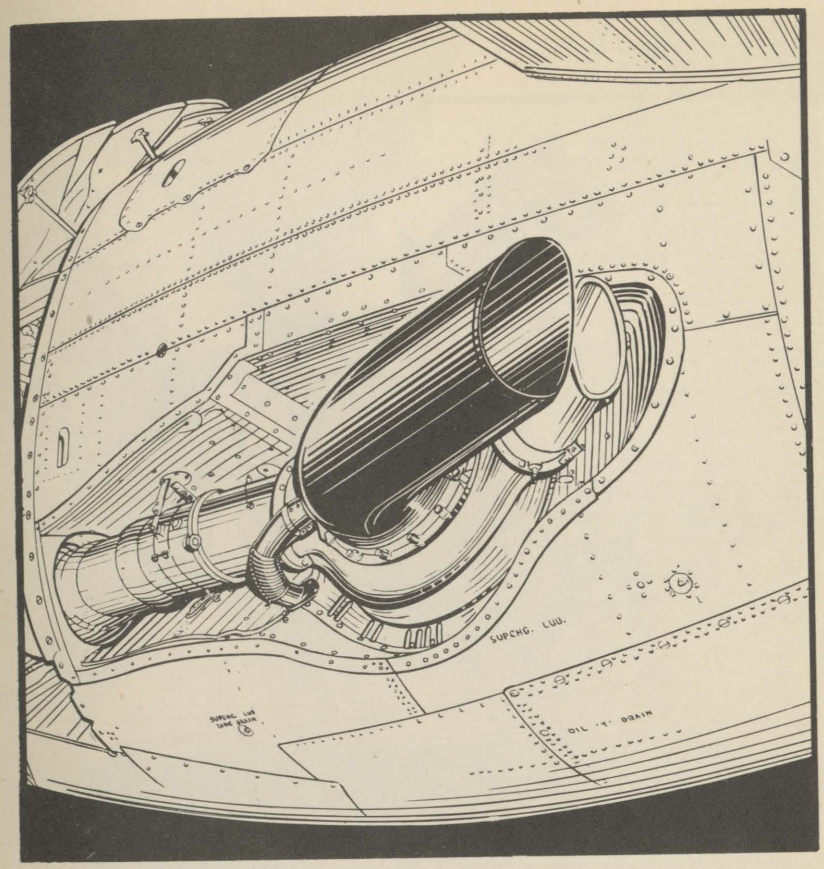
Set the manifold pressure to 47 inches of mercury on the ground as this will increase to 47.5 inches of mercury in flight.

Oil pressure may be permitted to drop to 40 pounds per square inch during engine idling.

The engines should be operated with as cold a carburetor air temperature as possible.

Heat should be applied only when required to avoid icing. Carburetor ice can be formed by the application of heat to the carburetor.

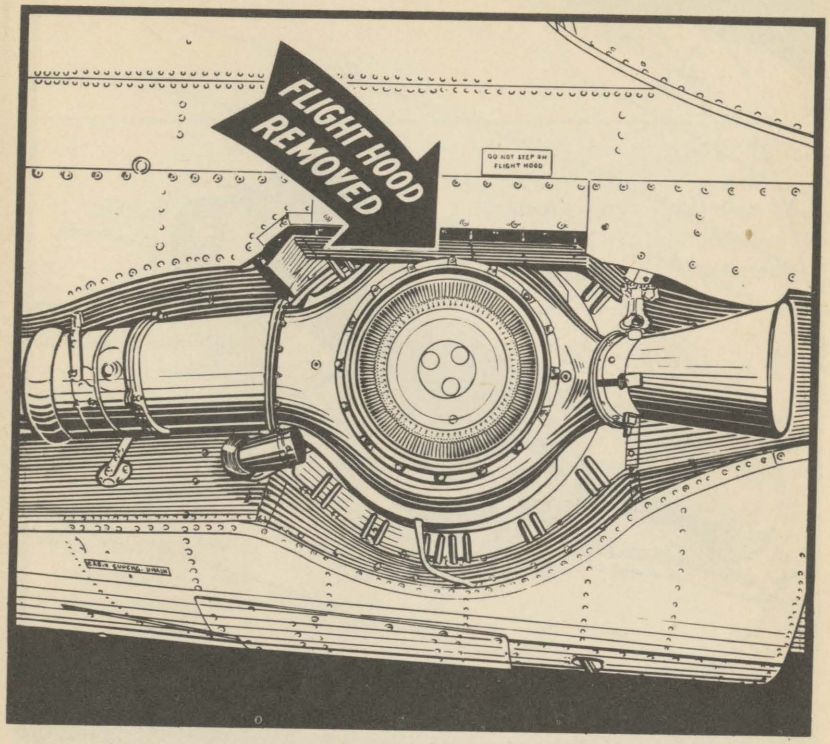
TURBOSUPERCHARGERS



Each engine is equipped with two type B-11 turbosuperchargers. They are governed by Minneapolis-Honeywell electronic controls powered by the airplane's 115-volt, 400-cycle alternating current. Intake manifold pressures are held automatically at a predetermined setting.

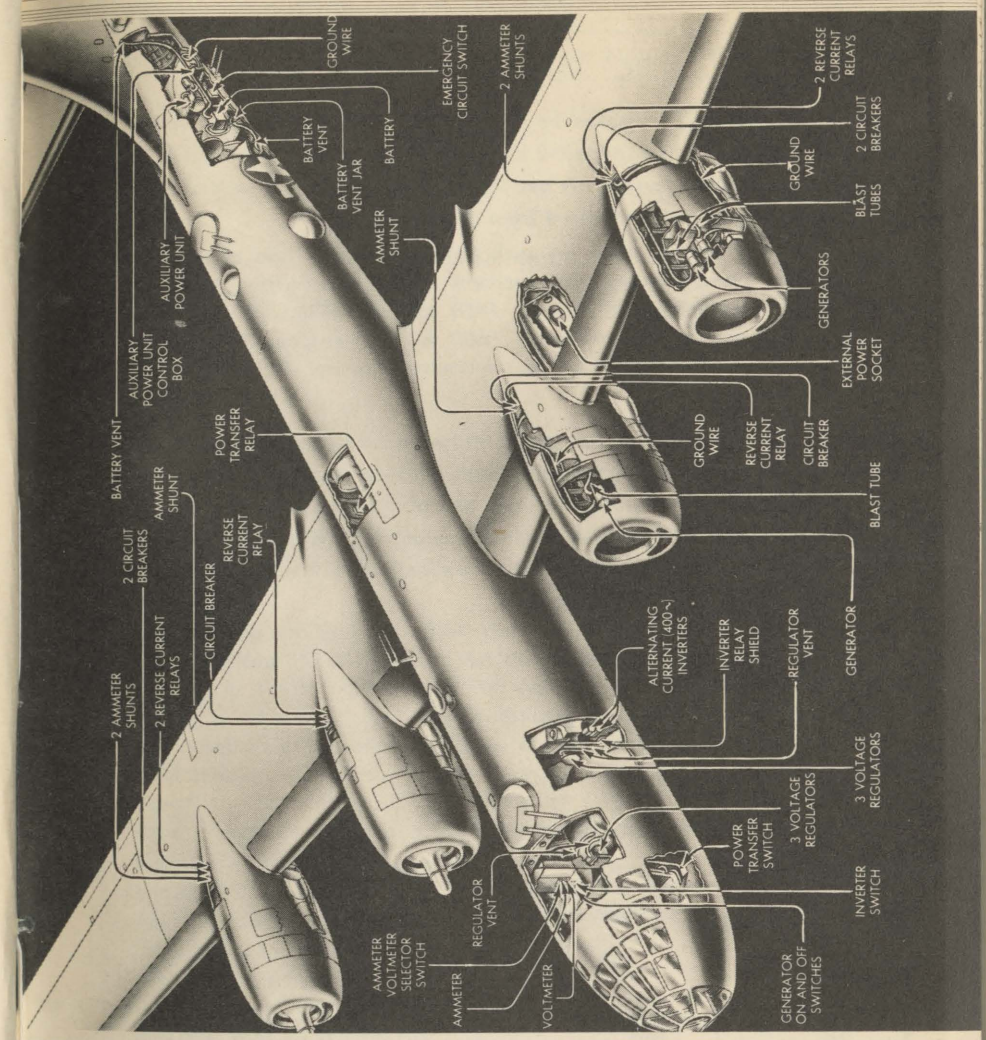
All turbosuperchargers are controlled by a single knob mounted on the aisle stand. This control knob is accessible to both the pilot and co-pilot. Set-screws are provided to level the manifold pressures of all engines when they are operating at the same rate of speed.

TURBOSUPERCHARGERS



The control also includes an automatic governor which prevents overspeeding of the turbosupercharger bucket wheels at high altitudes, and a means of damping surges of power at low speeds and under sudden power changes.

Four toggles mounted on the aisle stand allow individual propeller RPM control.



A.C.-D.C. POWER SUPPLY

ELECTRICAL SYSTEM SHOWING LOCATIONS OF AUXILIARY POWER PLANT, BATTERY, GENERATORS (6), AND OUTSIDE POWER PLUG.

ELECTRICAL SYSTEM

The electrical system is a 24 volt DC, and 26 volt and 115 volt AC single conductor system.

DC electrical power is supplied by six type P-2, 28 volt, 200 ampere engine driven generators and one type P-2 auxiliary driven generator. Either of two 750 volt-ampere inverters is available for alternating current supply. The inverter not in use is reserved as a standby unit.

Two generators are mounted on each outboard engine and one generator on each inboard engine. Fifty percent of the generator power is available at approximately 1380 to 1450 engine RPM. Full generator power is available at approximately 1600 to 1620 engine RPM. Generator performance is indicated by the voltmeter-ammeter located on the engineer's board.

The emergency retracting circuit (main and nose landing gear, wing flaps, and bomb doors) can be powered through either or both of two switches —the Landing Gear Transfer Switch on the pilot's engine control stand, which supplies power from the engine generators; the Bus Selector Switch on the battery solenoid shield, which supplies power from the auxiliary power plant and/or the 24 volt battery.

Take-offs and landings should be made with the auxiliary power plant in operation and the Bus Selector Switch in the NORMAL position.

A portable electric motor is provided for the operation of the wing flaps and bomb doors in case their normal motors fail.

NOTE: The normal stand-by current on the airplane is 715 amperes. The normal battle bombing load requires 1080 amperes. The total amperage available from all engine generators is 1200. When one outboard engine stops running, two generators become inoperative, causing a reduction in available current to 800 amperes. When one inboard engine stops running, one generator becomes inoperative, causing a reduction in available current to 1000 amperes. Since only one battery is supplied in the electrical system all generators must be operating to supply full current requirements.

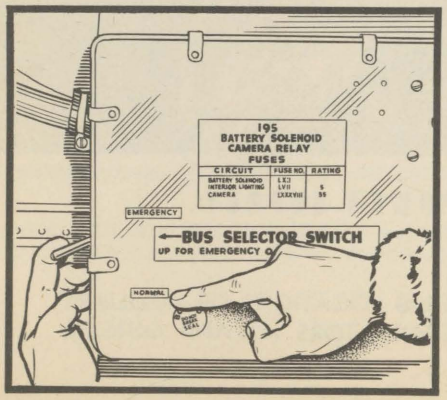


TABLE OF AMPERAGE LOADS

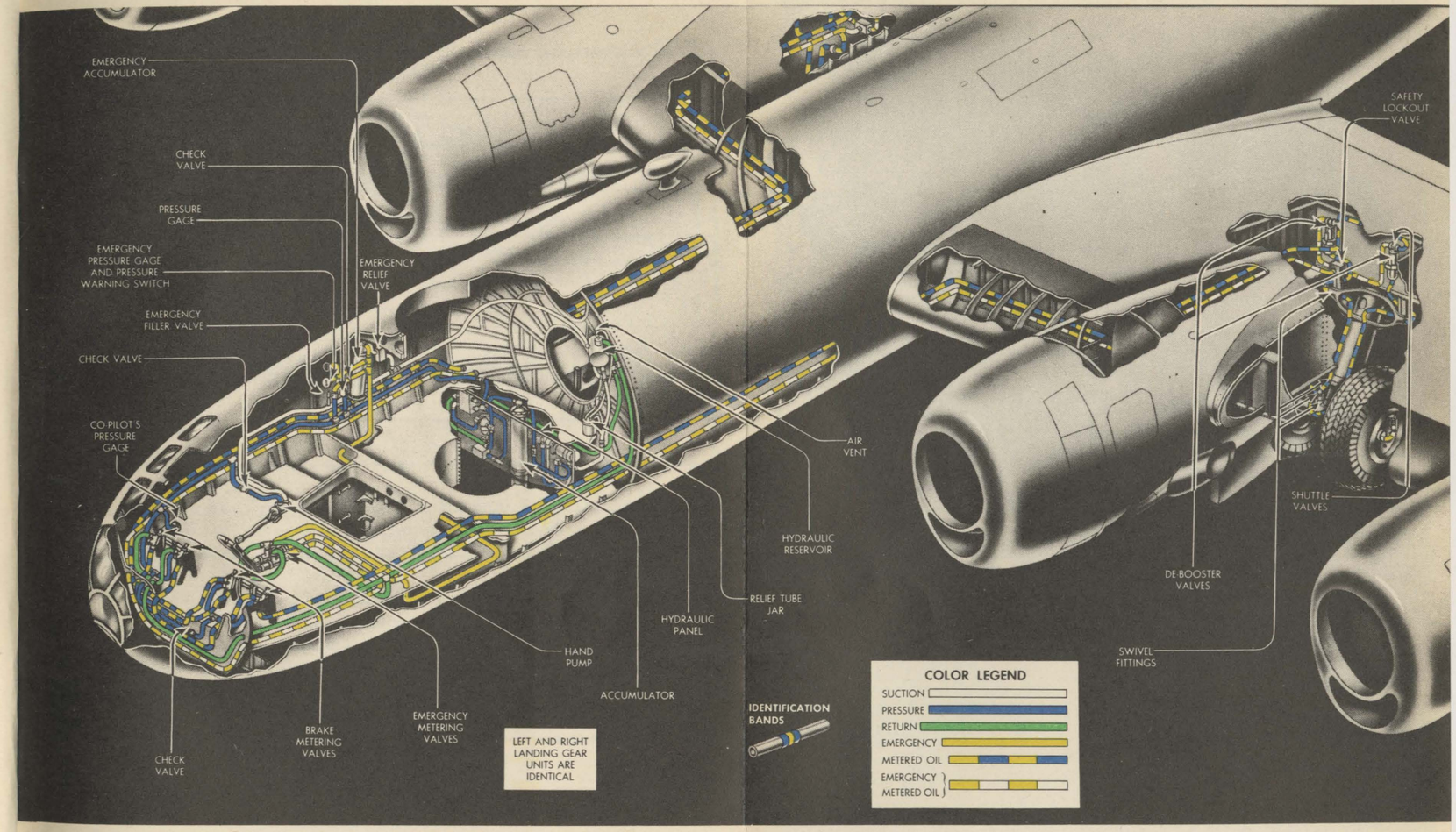
TABLE OF AMPERAGE LOADS

ITEM	NORMAL LOAD (amperes)	PEAK BATTLE LOAD (amperes)
Upper forward turret	132.5	275.5
Upper aft turret	132.5	275.5
Lower forward turret	84.	84.
Lower aft turet	84.	84.
Tail turret	242.	420.
Tail ammunition booster motors (2)	40.	40.
Cameras (3)	6.	6.
Camera heaters (3)	2.	2.
Flight clothing (for 10)	75.	150.
C-1 Auto pilot	6.	6.
Defroster blower motor (R.H.)	13.4	13.4
Defroster blower motor (L.H.)	25.	25.
Bomb doors forward	240.	240.
Bomb doors aft	240.	240.
Landing gear (2)	460.	460.
Nose gear	155.	155.
Wheel doors (2)	280.	280.
Propeller anti-icer pump (2)	4.2	4.2
Wing flaps	350.	350.
	715	1080

NOTES:

LIFT FOR HYDRAULIC SYSTEM (Page 23)

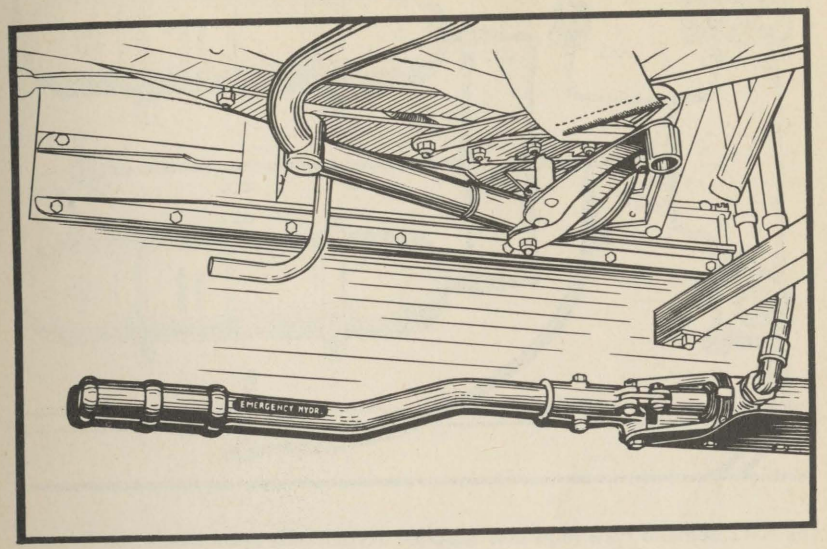
NOTES:



HYDRAULIC SYSTEM

NOTES:

HYDRAULIC SYSTEM

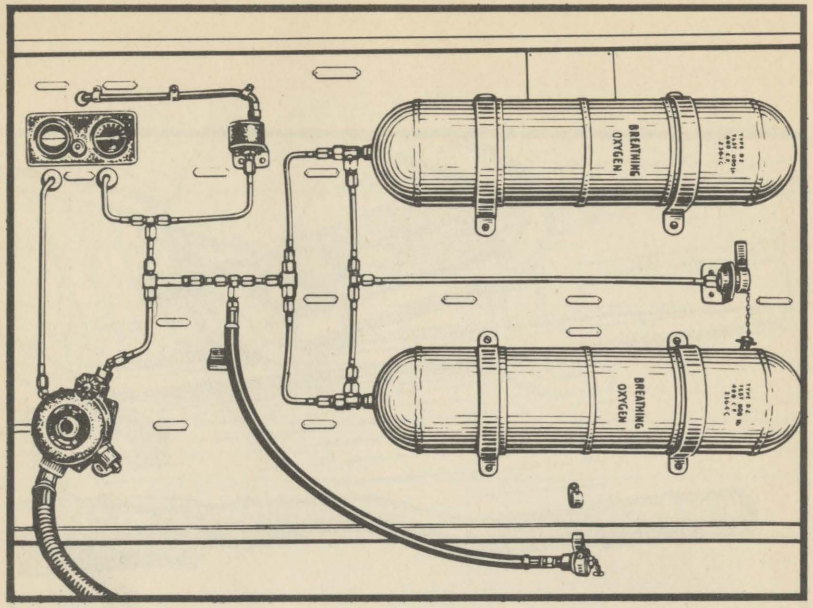


The hydraulic system is used only to actuate the airplane's brakes. Normal and emergency operation is provided separately within the system, each operating independently of the other.

Pressure in the accumulators is maintained between 800 and 1000 pounds per square inch by an electric pump controlled by an automatic electric pressure regulator. In case of failure of the electric pump, accumulator pressure can be maintained by an auxiliary hand pump located on the floor of the cockpit to the left of the co-pilot.

Recharging of the emergency system is required after five to seven applications of the emergency brakes.

OXYGEN SYSTEM (A-12 Regulator)



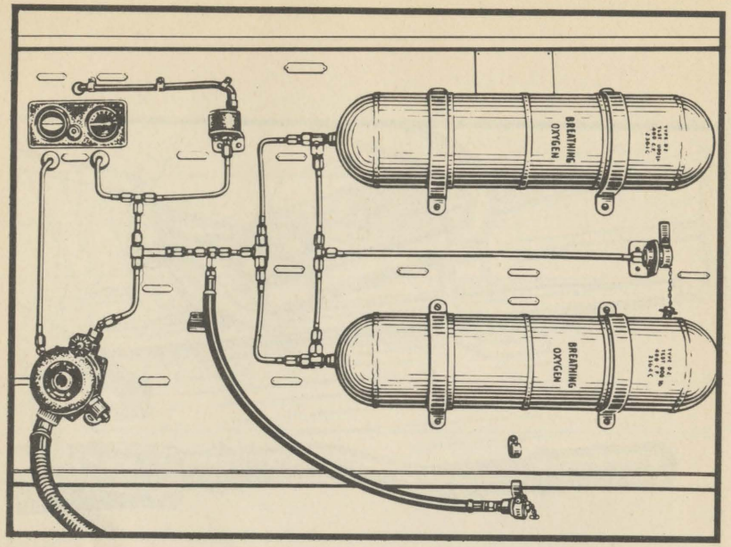
The A-12 demand type regulator supplies oxygen only upon inhalation through the masks. The supply valve closes automatically during exhalation, or when the mask is not in use. Regulation for altitude and amount required is automatic.

The regulator has two controls. The AUTO MIX lever, when turned to ON, supplies the proper mixture of oxygen and air. When turned to OFF, this lever does NOT turn off the oxygen supply.

NOTES:

LIFT FOR OXYGEN SYSTEM (Page 27)

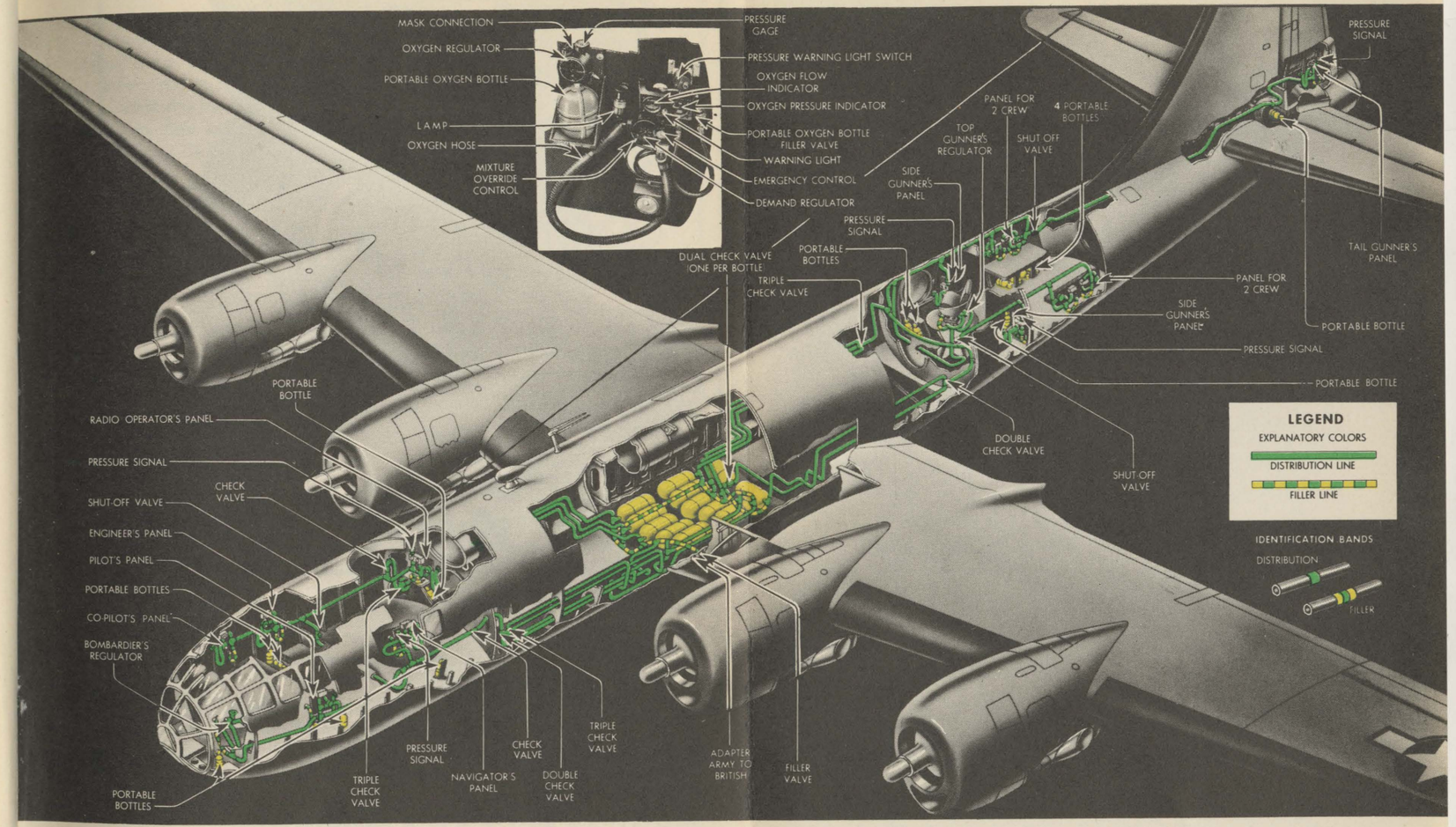
OXYGEN SYSTEM (A-12 Regulator)



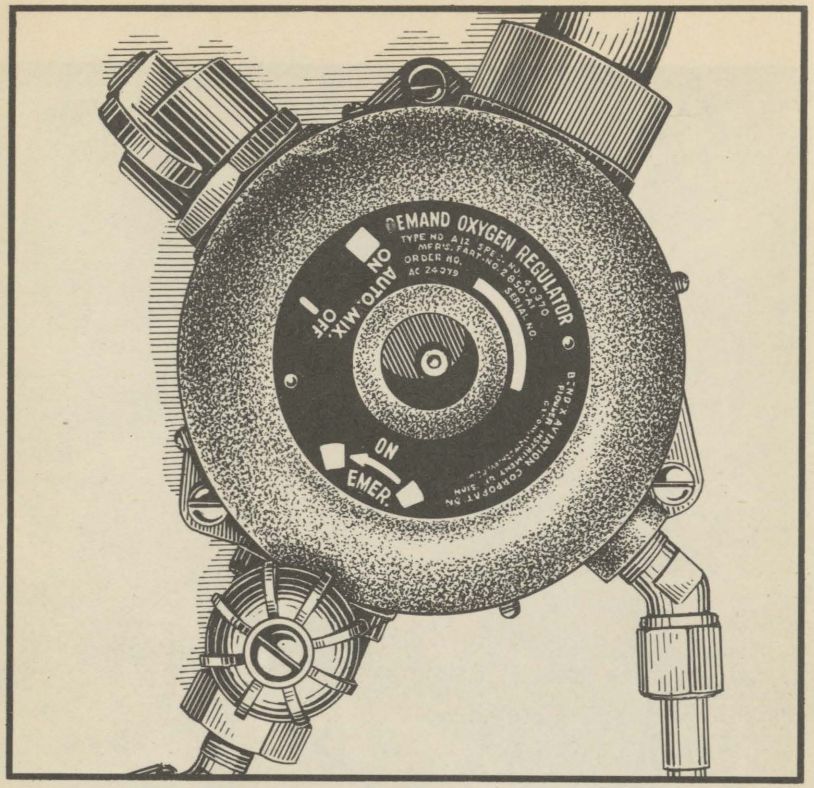
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NOTES:



OXYGEN SYSTEM

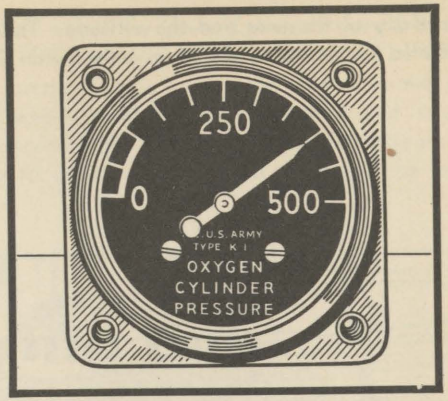


In the OFF position, no air is admitted to the system so that PURE OXYGEN IS SUPPLIED upon demand. Under normal conditions, it should be left ON. Do not leave the AUTO MIX lever at OFF except under special conditions.

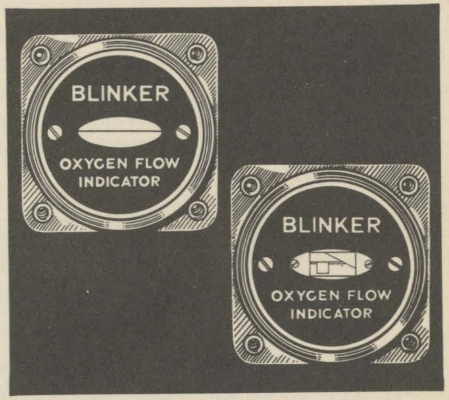
The regulator is equipped with an emergency control marked EMER. When this control is used, pure oxygen by-passes the demand portion of the regulator and flows continuously. This control should be used only in an emergency as it is extremely wasteful of oxygen and will empty the system quickly.

When using the emergency valve, do not obstruct the flow from the mask hose by pinching it since back pressure will rupture the diaphragm of the regulator.

The regulator is mounted on a panel which includes a system pressure gage, a flow indicator, and a warning light. The "blinker" type flow indicator shows when oxygen is being supplied through the regulator by its blinking action.



During inhalation, the segments of the blinker open; upon exhaling, they close. The flow indicator does not blink when the EMERGENCY valve is turned ON.
The warning light will go ON when the pressure in the system drops to 100 pounds.



Oxygen masks are personal issue and must be individually fitted.

Portable oxygen bottles are provided which may be refilled from the main oxygen system. These bottles last from five to eight minutes depending upon



the activity of the user and the altitude. This bottle is not equipped with automatic mix features and gives only PURE OXYGEN upon demand.

OXYGEN CHECK LIST

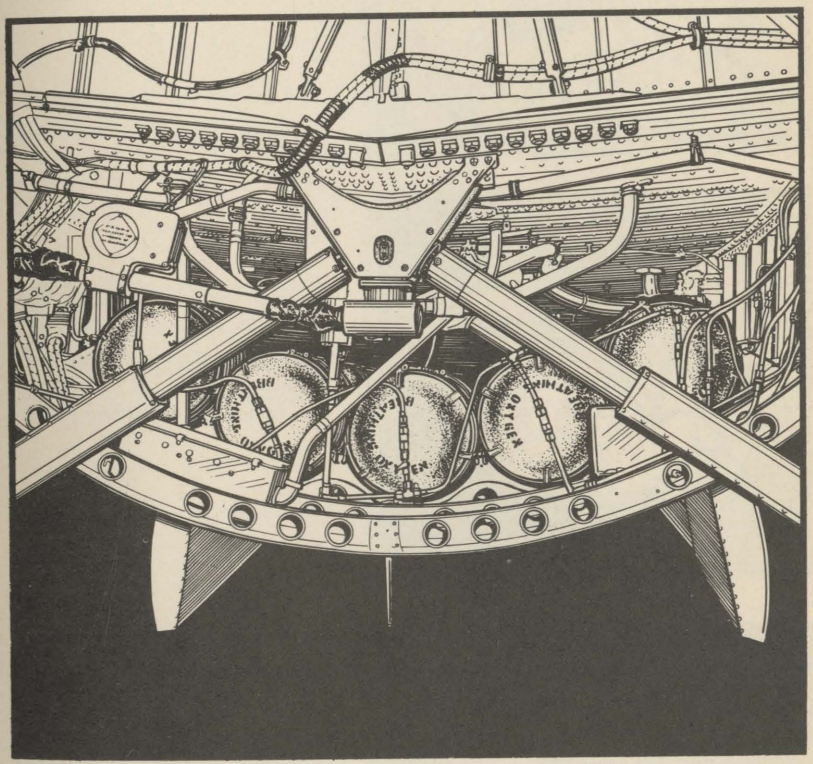
The airplane is supplied with 12 type G-1 shatterproof oxygen cylinders. Each cylinder supplies one man with sufficient oxygen for about four hours at 25,000 feet (with the AUTO-MIX lever at ON). The most uneconomical altitude for oxygen is at 25,000 feet. Oxygen duration varies depending upon the altitude, activity of the user, and the type of regulator. The following table shows oxygen duration when used with an A-12 regulator (Bendix-Pioneer):

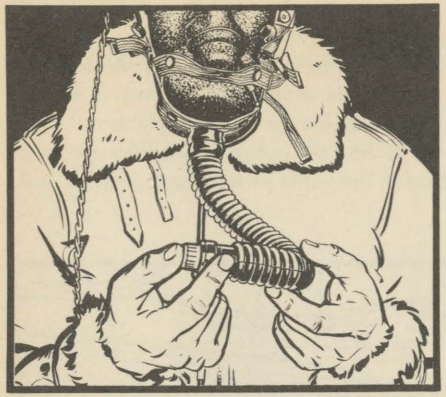
(A-12 Bendix-Pioneer Regulator with one type G-1 oxygen cylinder)

Altitude (feet)	Hours Supply Auto-mix		Gage Pressure (pounds per square inch)	Percent of Supply Remaining
	On	Off		
0	6.0	1.0	400	100
5,000	5.5	1.3	350	85
10,000	7.0	1.6	300	70
15,000	7.2	1.9	250	60
20,000	7.5	2.4	200	40
25,000	4.0	3.1	150	30
30,000	4.4	4.2	100	14*
35,000	5.6	5.6	50	**
40,000	8.0	8.0	0	—

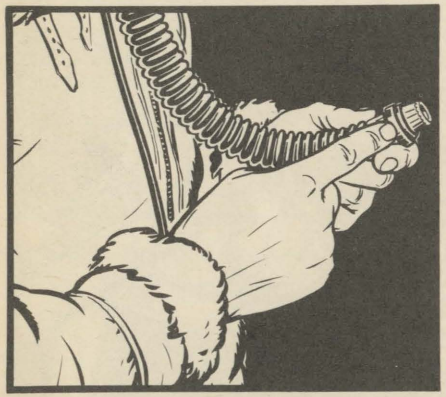
* Warning ** Emergency

There are two oxygen shut-off valves, one in the forward pressure compartment and one in the rear pressure compartment. Normally, these valves will be OFF. In case the oxygen supply is shot out on one side or the other, the valve may be opened, making the remaining oxygen available to the section shot away. WARNING: If the oxygen is shot away in the lines in the cabin downstream of the check valves to the tanks, do not open the valve as all oxygen will be lost. See diagram.





Check the fit of the mask by holding your thumb over the quick disconnect fitting and inhaling gently.

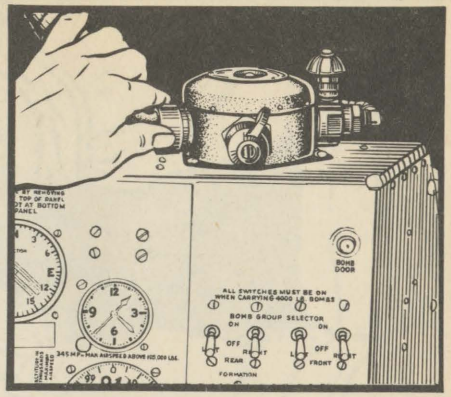


Be sure the gasket is on the male quick-disconnect fitting. The fitting should fit snugly, requiring about a 10 pound pull to separate the two parts.

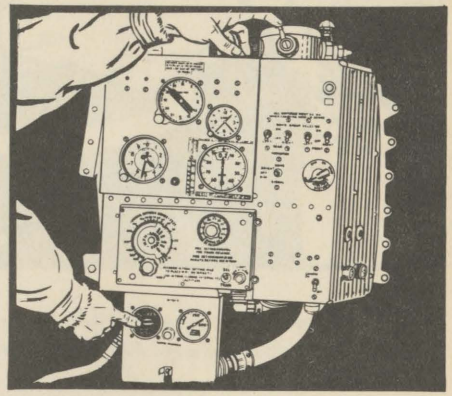


Clip the oxygen hose to the clothing close enough to the face to permit free head movement.

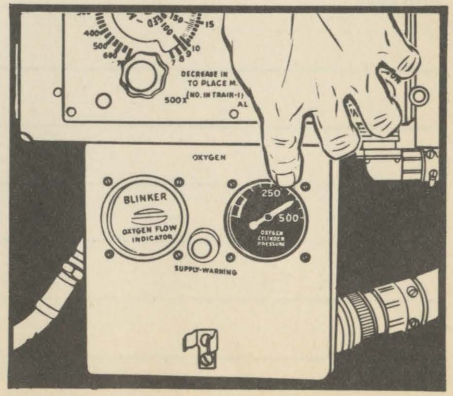
Be sure that the knurled collar is tight. Check to see that the diaphragm is intact. Check the emergency valve to see if oxygen flows, then close the valve firmly.



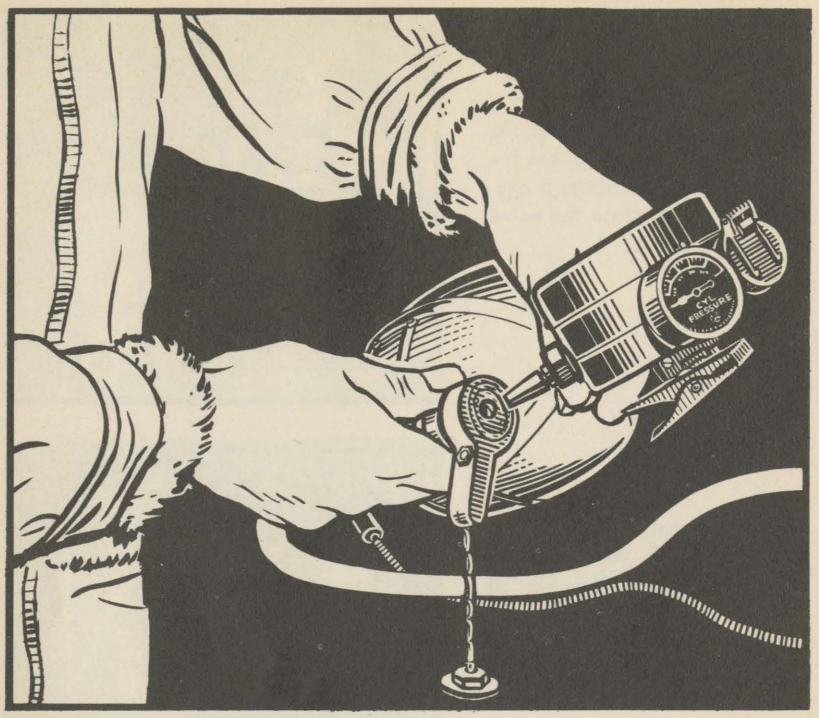
Breathe from the regulator normally with the auto-mix OFF to check the function of the flow indicator. Turn the auto-mix to the ON position.



Check the oxygen pressure at each station. Pressure should be 400 to 425 pounds per square inch.



OXYGEN CHECK LIST

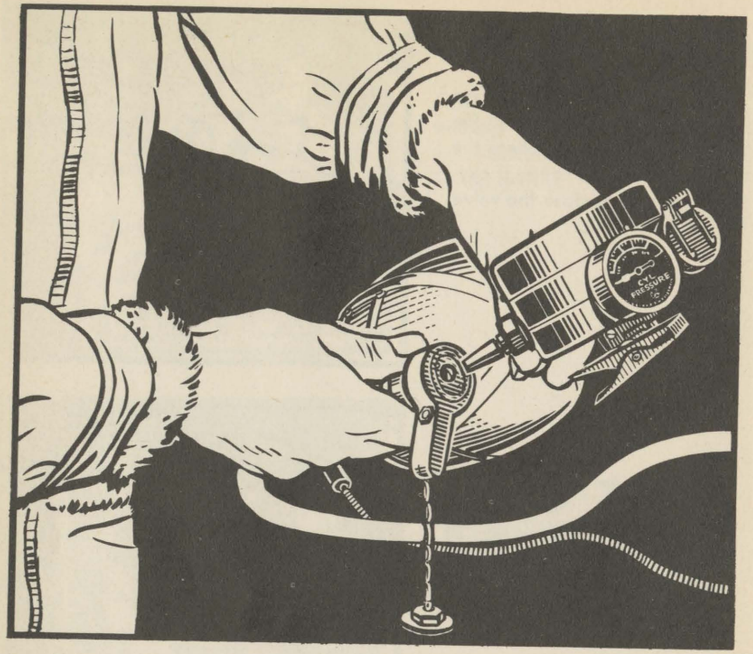


Charge the portable oxygen bottles. Pressure should equalize with the oxygen pressure within the airplane. Always recharge the bottle after using.

NOTES:

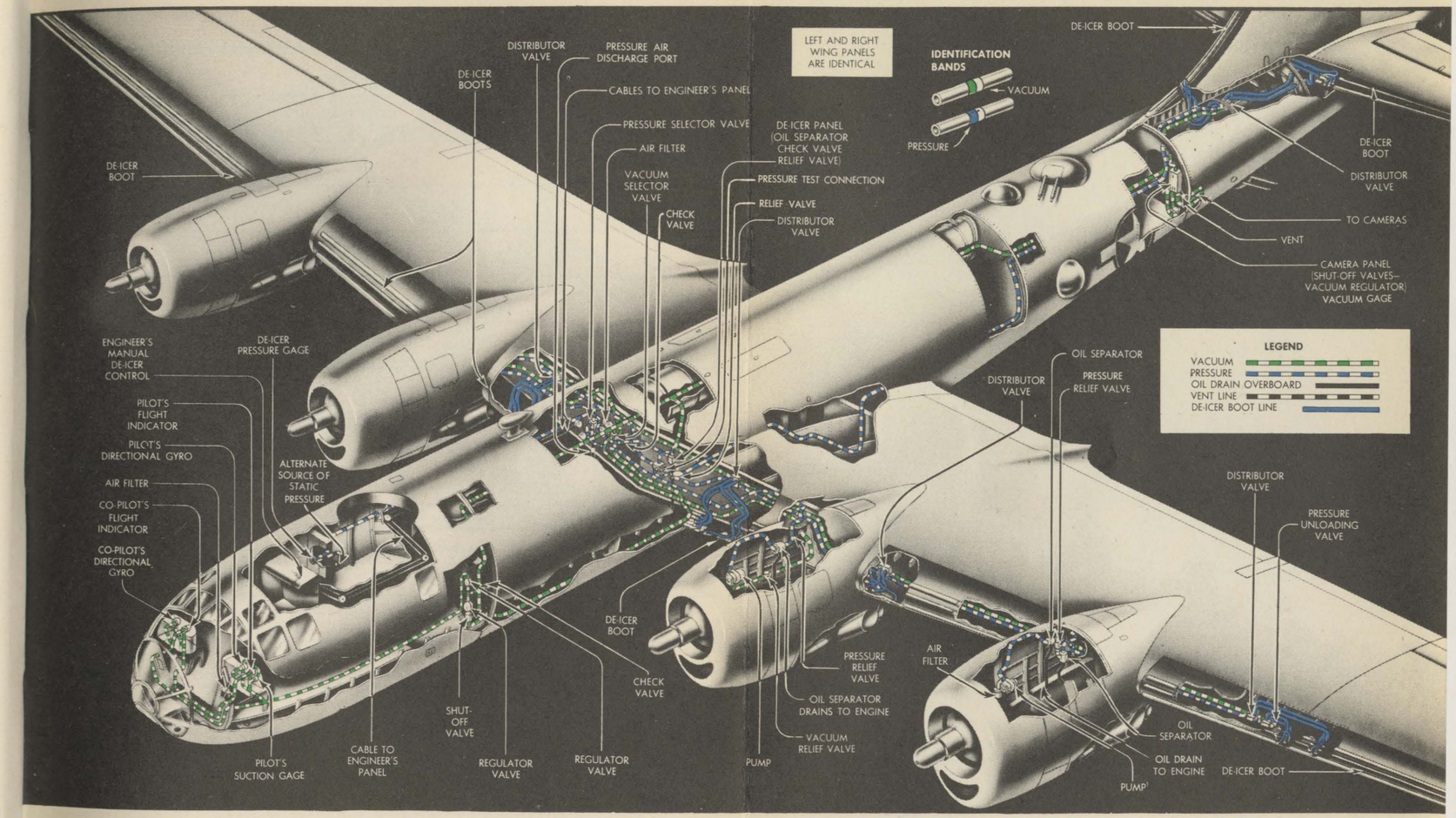
LIFT FOR VACUUM AND DE-ICER SYSTEM [Page 35]

OXYGEN CHECK LIST



Charge the portable oxygen bottles. Pressure should equalize with the oxygen pressure within the airplane. Always recharge the bottle after using.

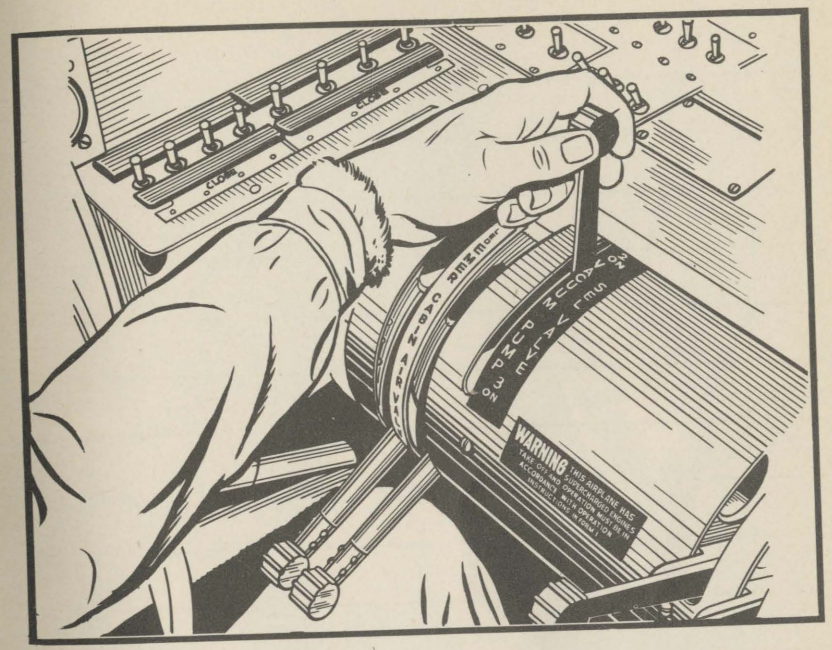
NOTES:



VACUUM AND DE-ICER SYSTEM

NOTES:

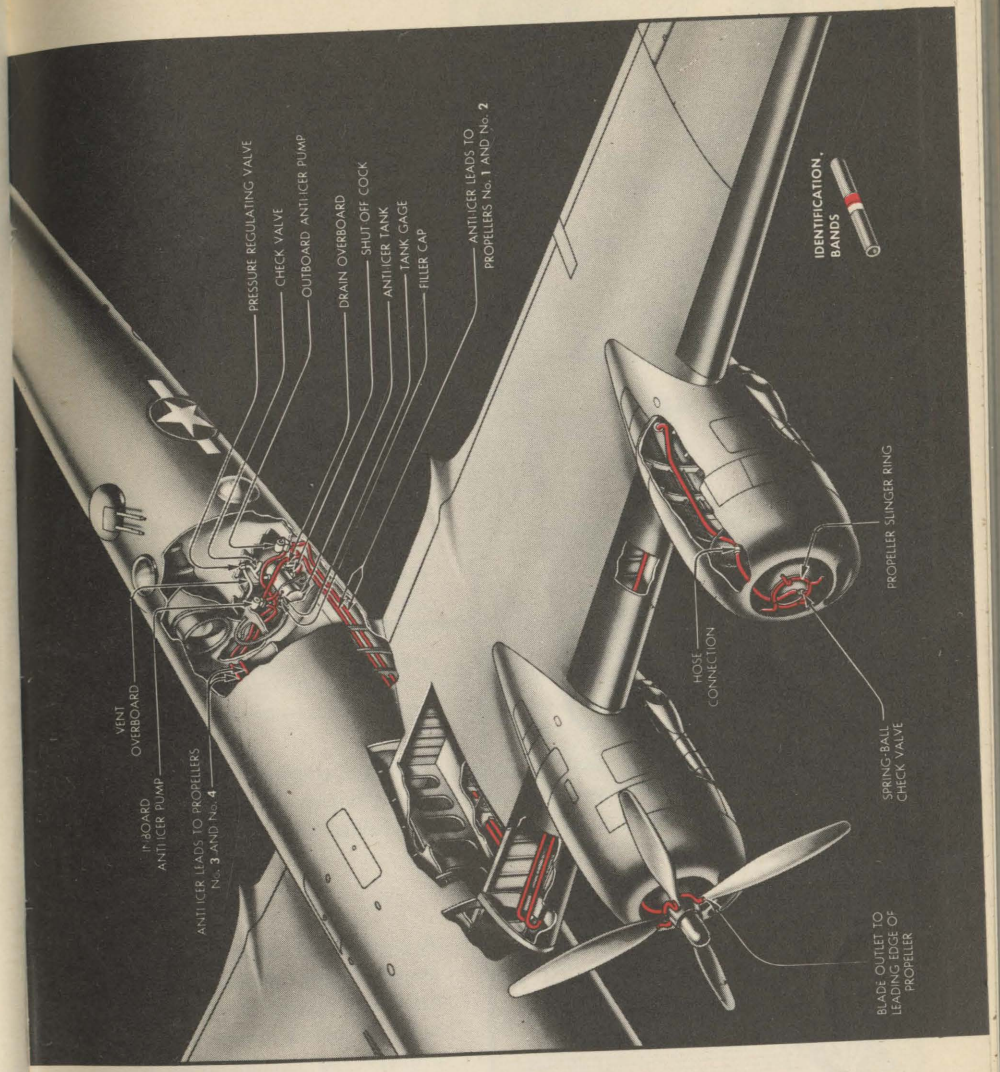
SURFACE DE-ICER AND VACUUM SYSTEM



The surface de-icer system consists of rubber "boots" which are installed on the leading edges of the wing, and of the vertical and horizontal stabilizers. A toggle switch on the flight engineer's switch panel is used to turn the system ON or OFF.

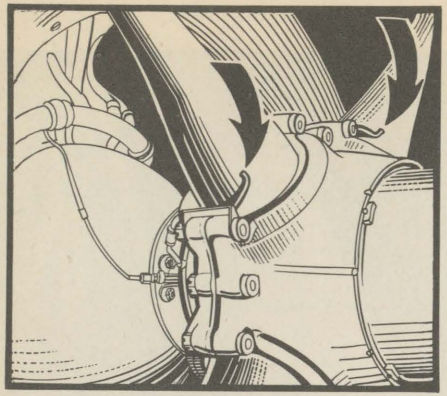
Vacuum pumps supply the vacuum required to operate the gyro instruments. Selection of the pumps is controlled by the vacuum selector valve on the engineer's control stand.

NOTES:

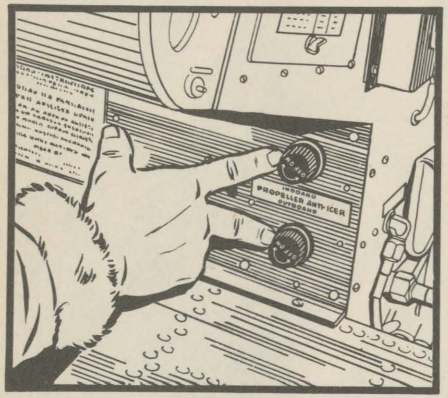


PROPELLER ANTI-ICER FLOW DIAGRAM

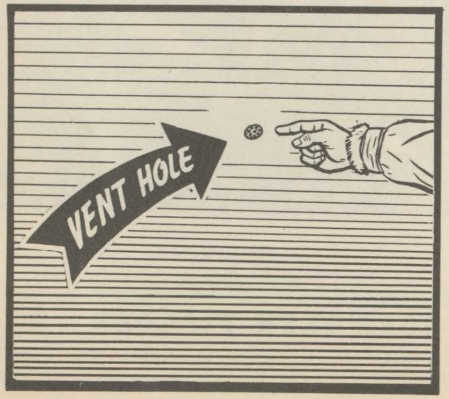
PROPELLER ANTI-ICING



To prevent ice from sticking to the propeller blades, anti-icing fluid (specification AN-F-13 iso-propyl alcohol) is distributed along the leading edge of each blade. This distribution is effected through nozzles, one of which is mounted at the root of each blade on the propeller slinger ring.

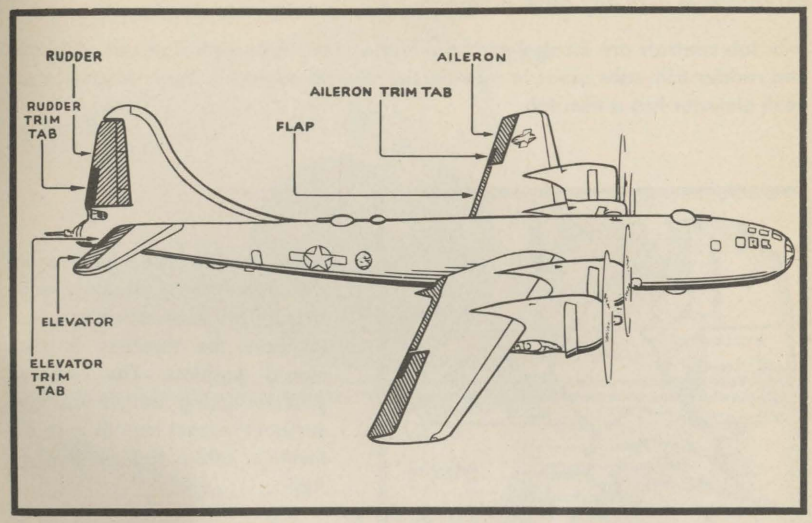


Two electrically-driven pumps carry the fluid from a tank to the propeller slinger ring. The rate of flow of the anti-icing fluid is regulated by two rheostats on the engineer's stand.



A special vent system prevents compartment pressure from escaping through the tank. The tank is vented overboard to prevent the accumulation of alcohol fumes.

SURFACE CONTROLS



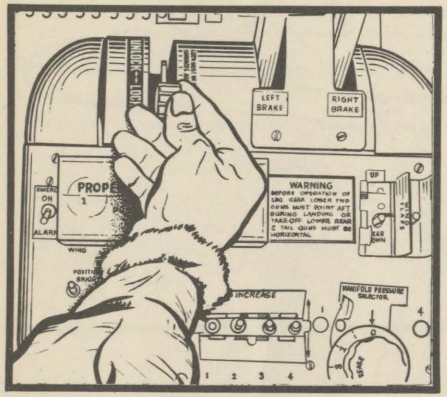
Ailerons and elevators are operated by the pilot's and co-pilot's control wheels and control columns. The rudder is controlled by foot pedals.

A bus cable connects the right and left aileron drums, so that if either the pilot's or co-pilot's cables break, the remaining cables will control both ailerons. However, if the bus cable breaks, each pilot will have control of only one aileron.

SURFACE CONTROLS

The pilot's and copilot's elevator cables are connected to the elevator torque tube. If either set of cables breaks, the remaining set will control the elevators. Rudder pedals are connected under the floor of the forward compartment. Since the airplane can be own without using the rudder, no provision is made for rudder control in case any cable is broken.

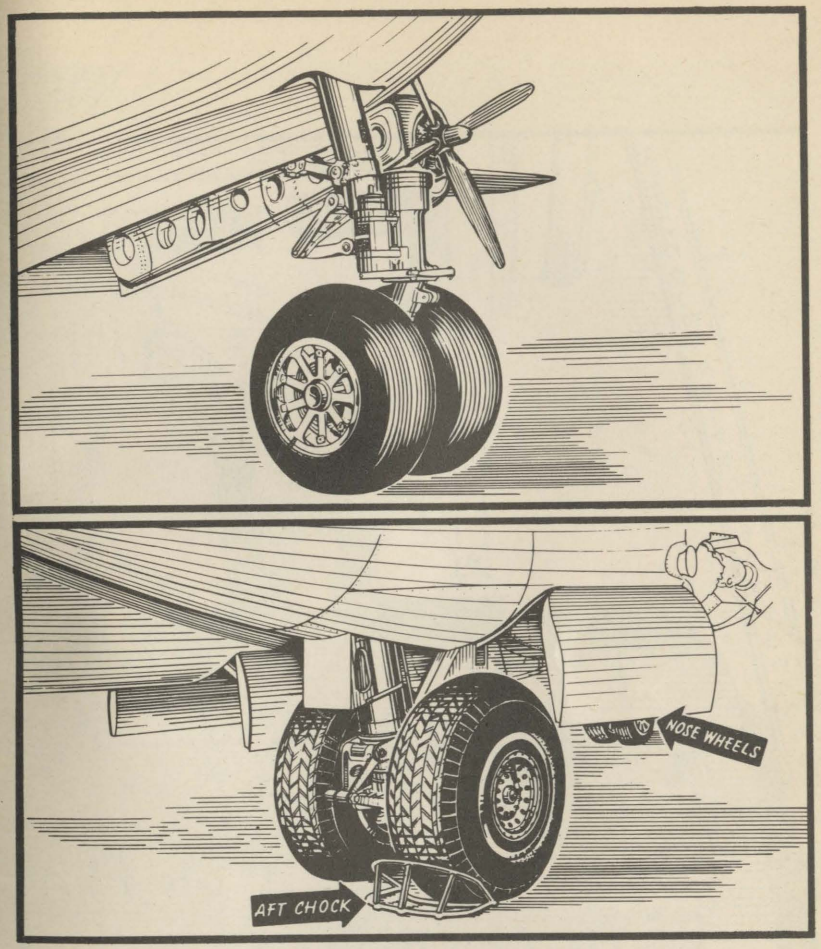
Trim tab controls are located on the pilot's and copilot's control stands. Aileron and rudder trim tabs assist in moving the control surfaces. Each aileron and each elevator has a trim tab.



A lever on the aisle stand is provided for locking all control surfaces. This lever simultaneously locks the throttles in the closed position. The locking pins are spring loaded and the surfaces cannot lock in case of locking cable failure during flight.

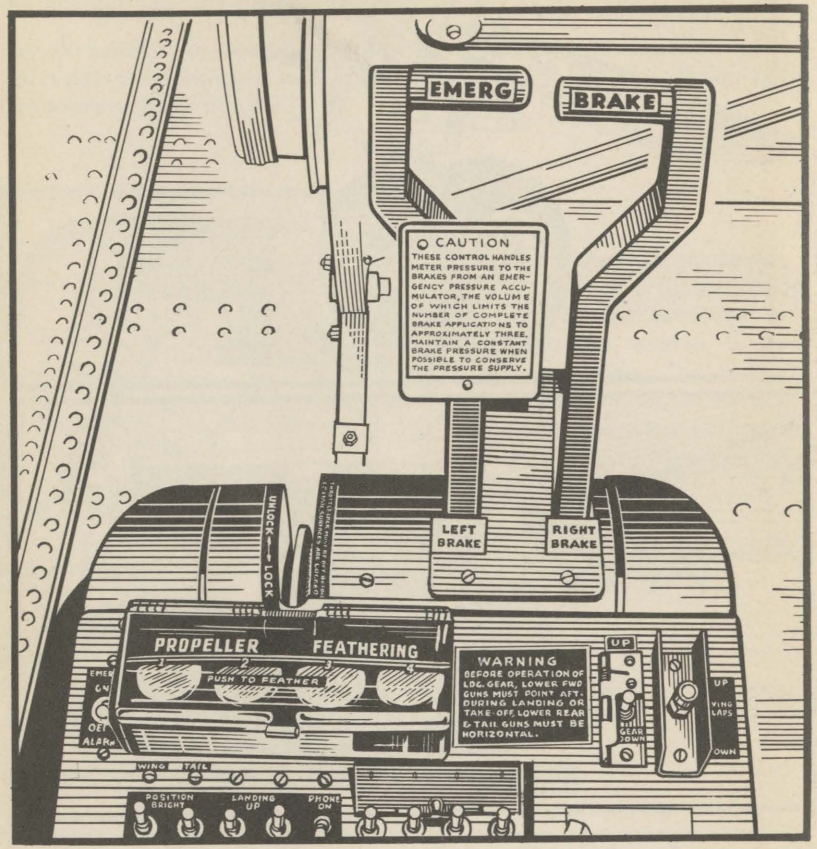
NOTES:

LANDING GEAR

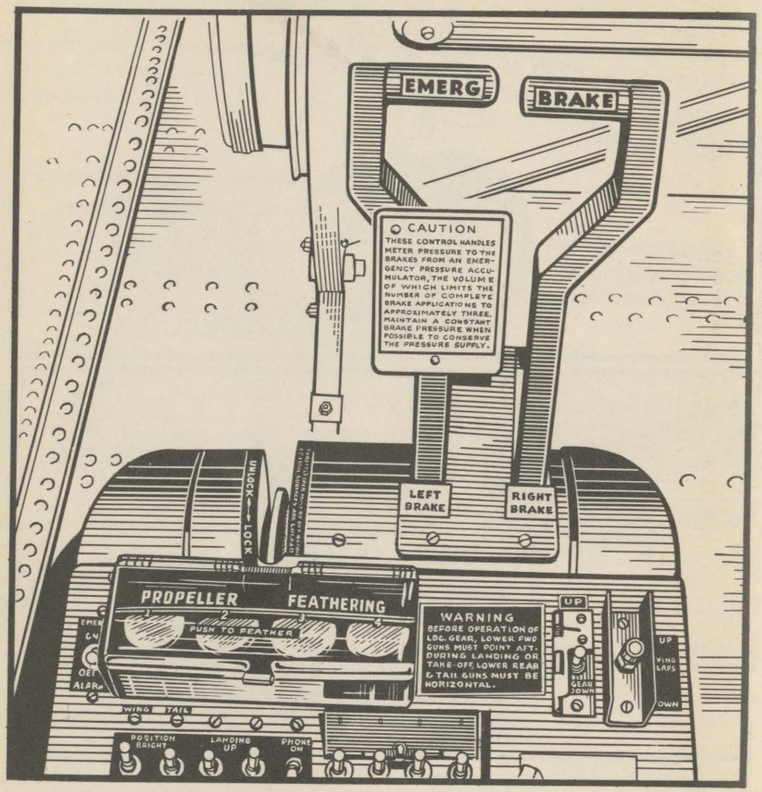


The airplane has a tricycle landing gear consisting of a dual nose wheel and dual main wheels. Extension and retraction of the gear is accomplished electrically. The landing gear motors are controlled by a toggle switch on top of the aisle stand where it is accessible to the pilot and co-pilot. Emergency controls are accessible only to the pilot.

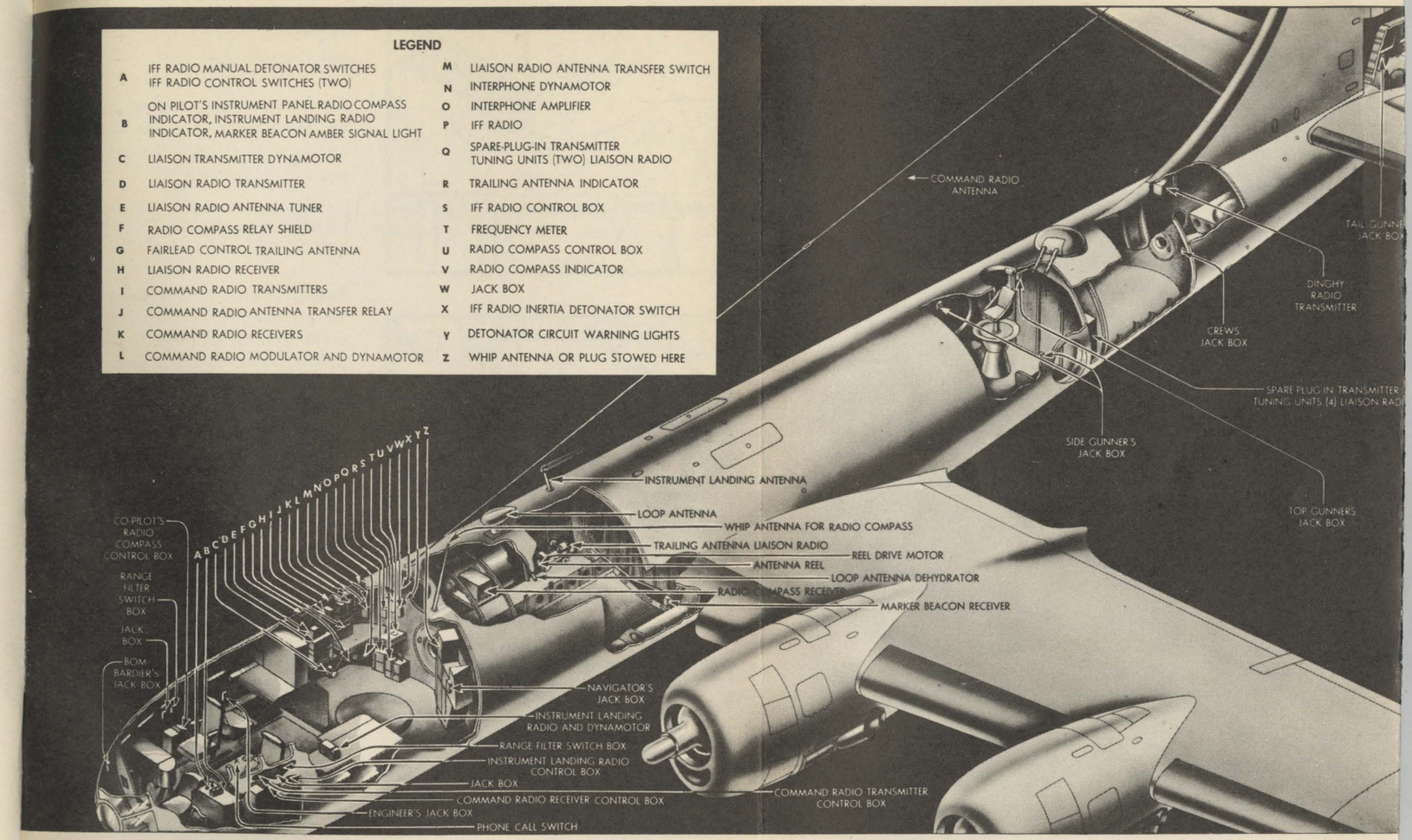
The nose wheel has no brake, but each main wheel has dual brakes. To apply the parking brake, both rudder pedals are depressed and the parking brake knob on the pilot's rudder pedal stand is pulled out. To release the parking brake, depress the brake pedals.



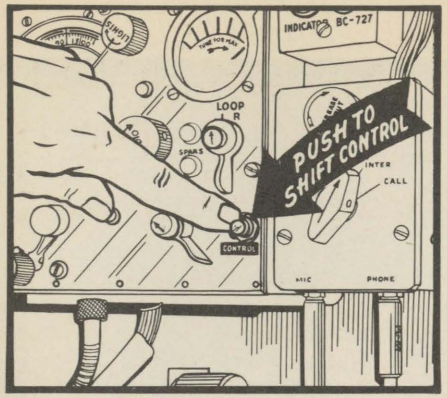
Emergency brakes are applied by means of levers on the aisle stand.

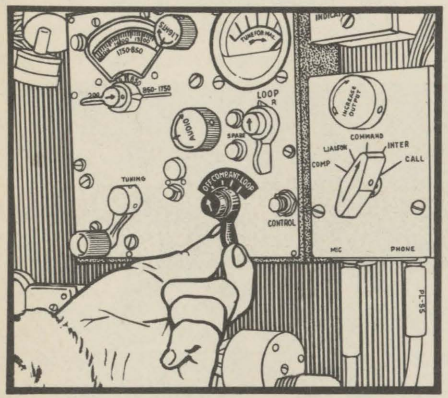


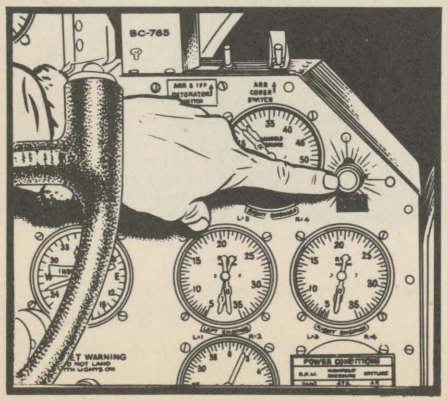
Emergency brakes are applied by means of levers on the aisle stand.



COMMUNICATION SYSTEM







Eleven jack boxes enable any crew member to connect his earphones and microphone into the various circuits.

Controls for the command receiver are mounted at the left of the pilot as he is the only one who operates it.

Liaison equipment is controlled only by the radio operator.

Radio compass control panels are provided for the radio operator and the co-pilot. Either panel may be selected as the operating station by pushing a button, which shifts control.

A selector switch on each panel provides ANTENNA, LOOP, and COMPASS positions. With the switch at ANTENNA, the equipment operates as a simple radio receiver. Setting the switch at LOOP allows bearings to be taken. With the switch at COMPASS, the equipment automatically indicates the direction of the station to which the set is tuned.

The marker beacon equipment is turned ON by the radio compass switch and its operation is automatic. An amber lamp on the pilot's instrument panel indicates the position of the airplane with relation to a CAA fan-type or cone of silence

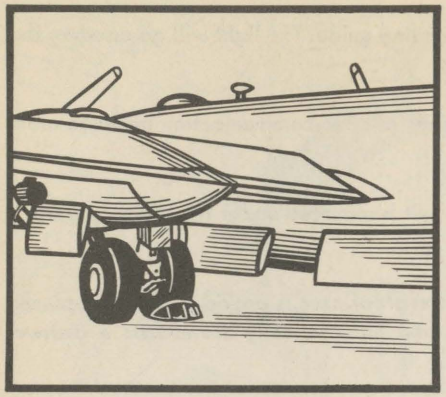
transmitter, or an Army instrument landing guide. The light will go on when the airplane is over any of these sources.

An interphone system provides a means of inter-communication between crew members.

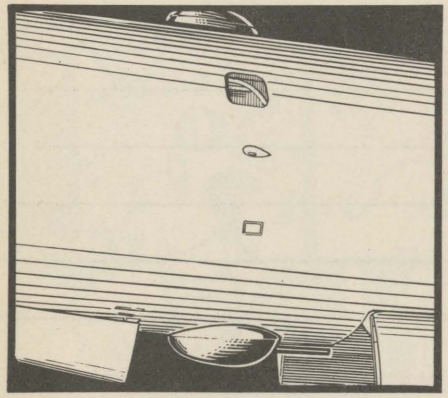
An iFF (Identification Friend or Foe) unit is mounted under the radio operator's table.

A portable radio transmitter in a waterproof case is provided in the airplane. Powered by a hand generator, this unit automatically broadcasts a distress signal.

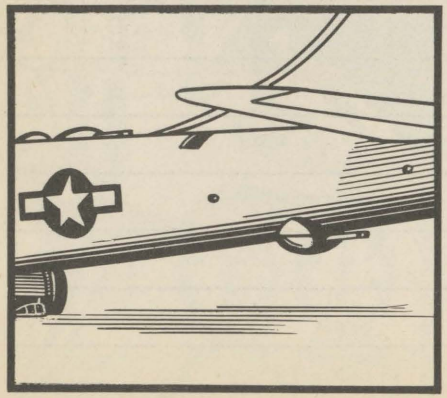
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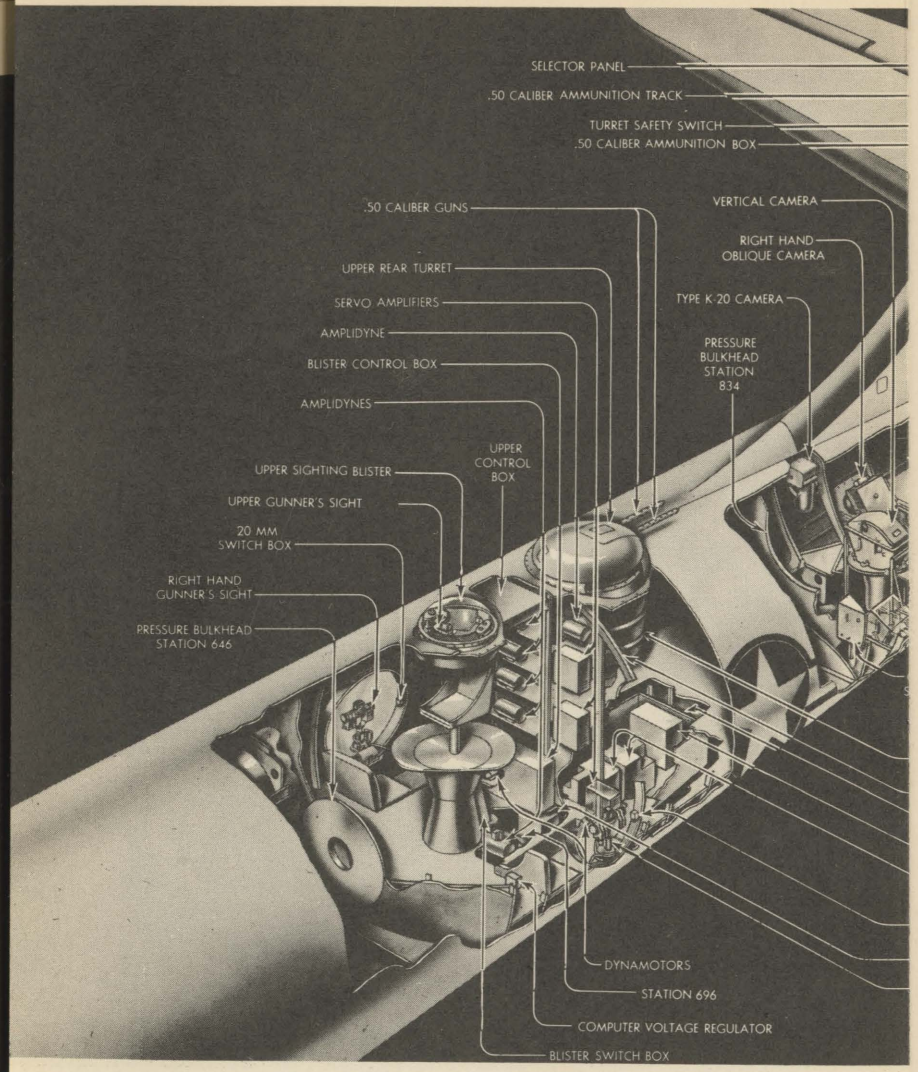
Each of the five turrets is equipped with two 50-caliber machine guns. The upper forward turret is on top of the forward pressurized compartment. The upper rear turret is on top of the aft pressurized compartment. Both turrets are remotely controlled by the top gunner, whose station is in the aft pressurized compartment.



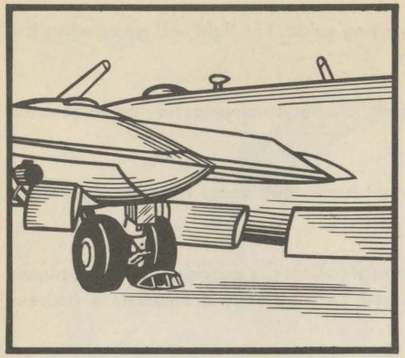
The lower forward turret is on the bottom of the forward pressurized compartment. The bombardier has primary control and either side gunner has secondary control of this turret.



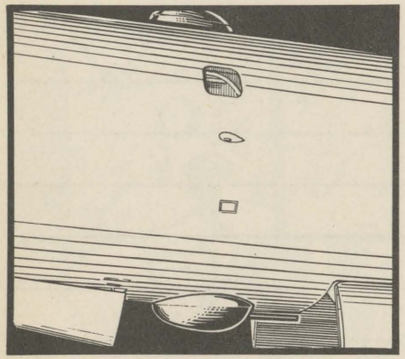
The lower rear turret, on the bottom of the airplane in the unpressurized tail section behind the aft pressurized compartment is controlled by the side gunners.



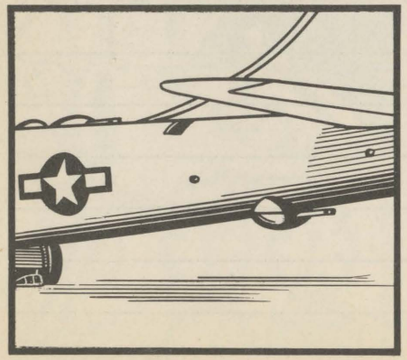
REAR GUN AND CA



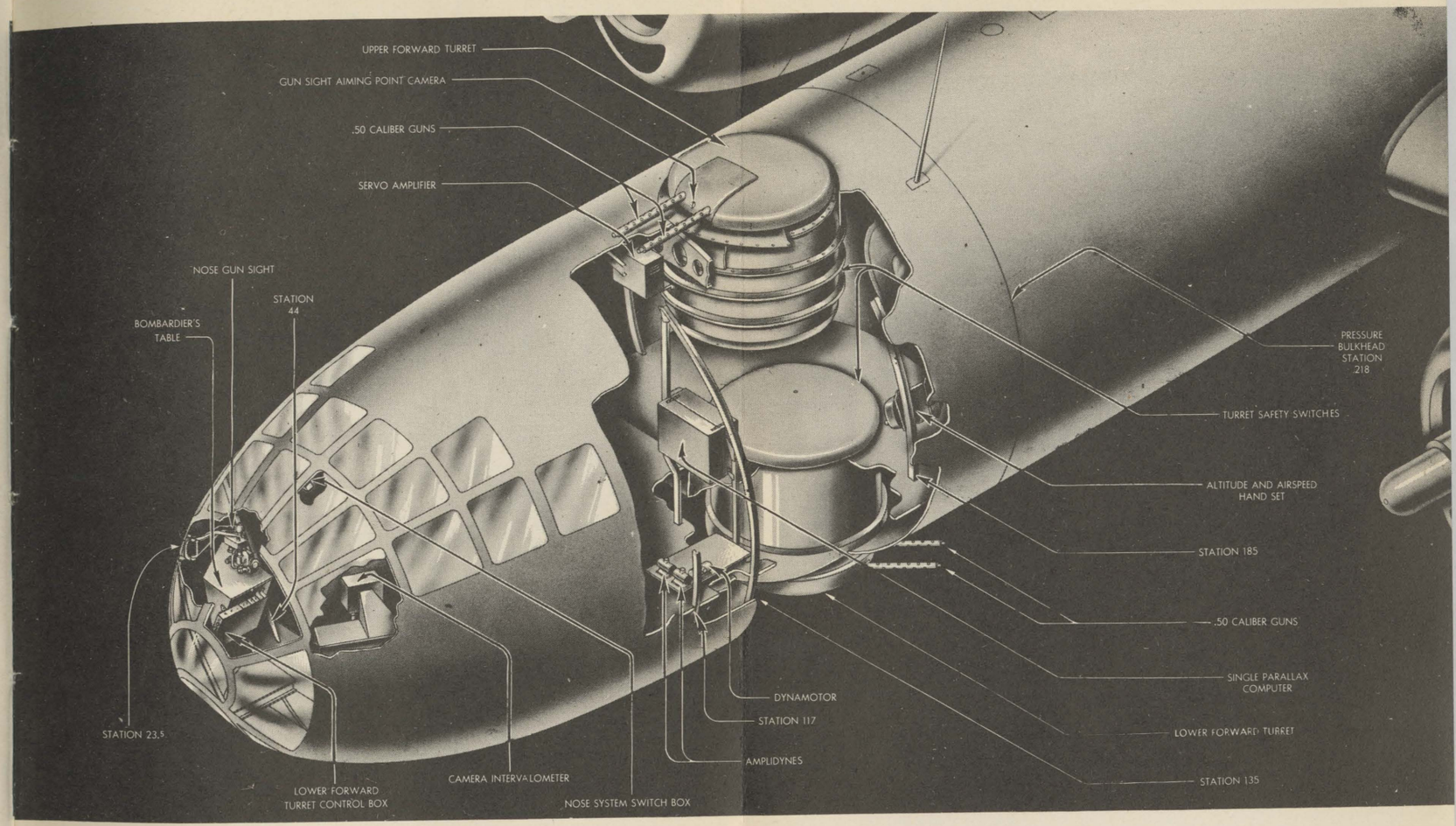
Each of the five turrets is equipped with two 50-caliber machine guns. The upper forward turret is on top of the forward pressurized compartment. The upper rear turret is on top of the aft pressurized compartment. Both turrets are remotely controlled by the top gunner, whose station is in the aft pressurized compartment.



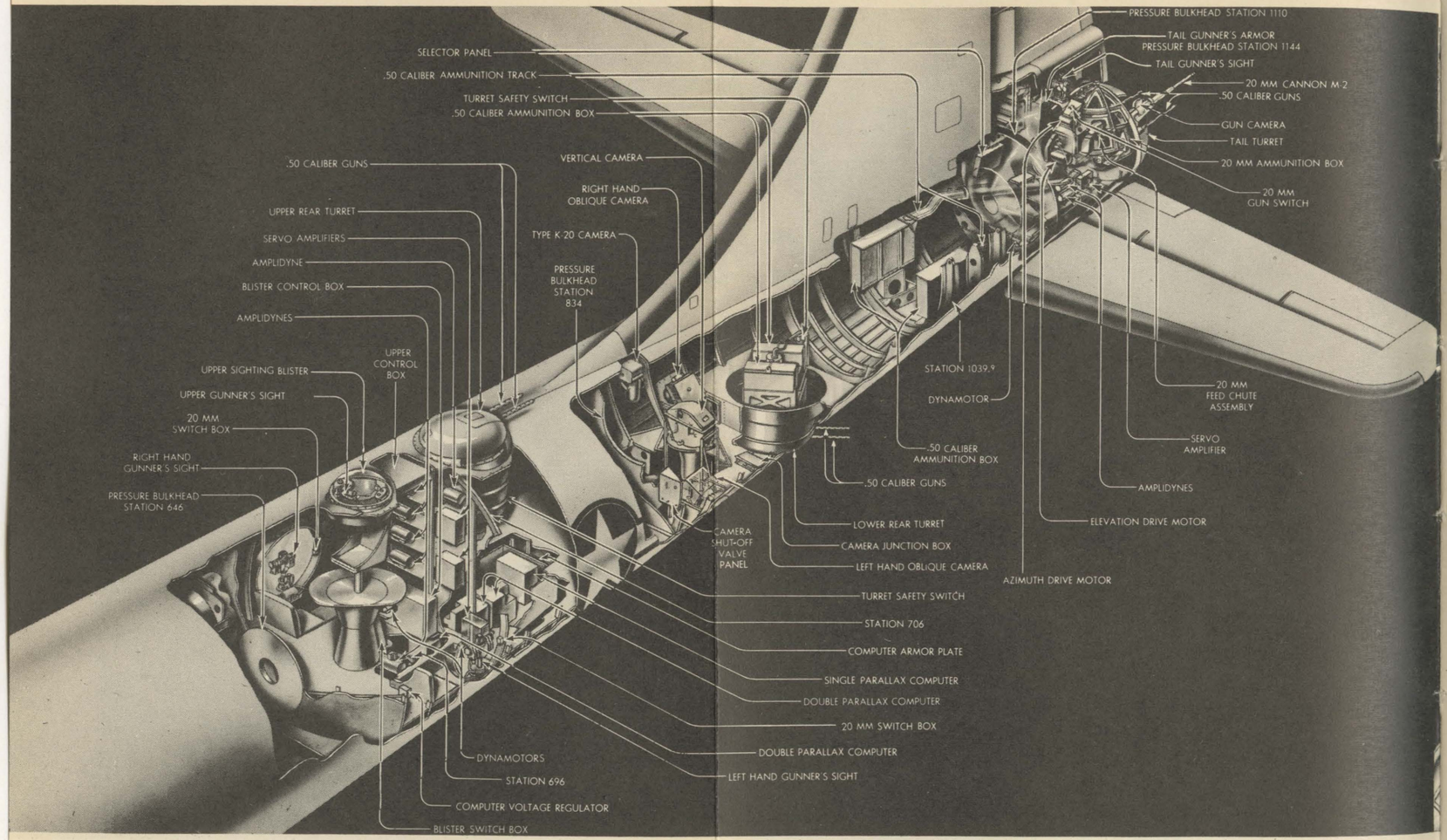
The lower forward turret is on the bottom of the forward pressurized compartment. The bombardier has primary control and either side gunner has secondary control of this turret.



The lower rear turret, on the bottom of the airplane in the unpressurized tail section behind the aft pressurized compartment is controlled by the side gunners.



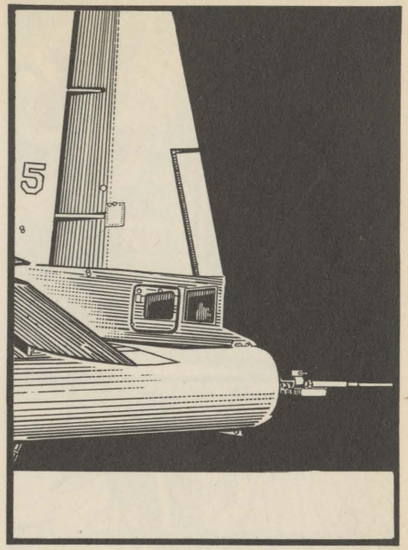
FORWARD GUN AND CAMERA LOCATIONS



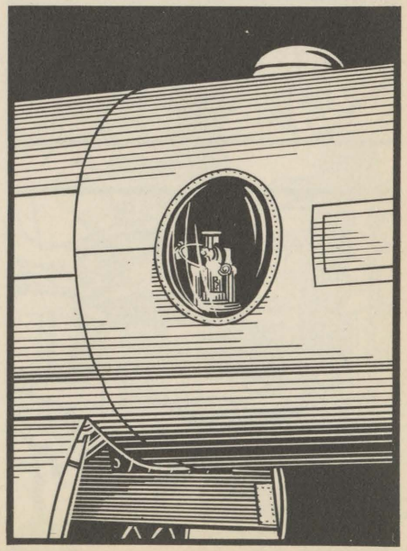
REAR GUN AND CAMERA LOCATIONS

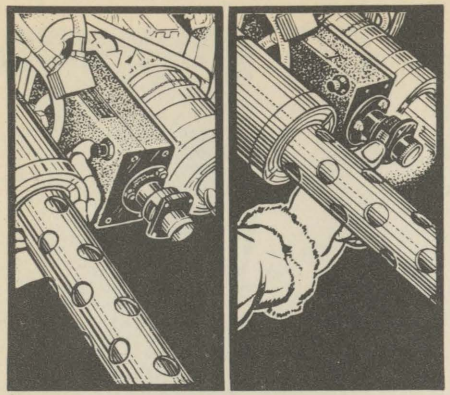
The tail turret is in the tail gunner's compartment at the extreme aft end of the airplane. The tail gunner has primary control and either side gunner has secondary control of this turret.

All guns are electrically controlled.

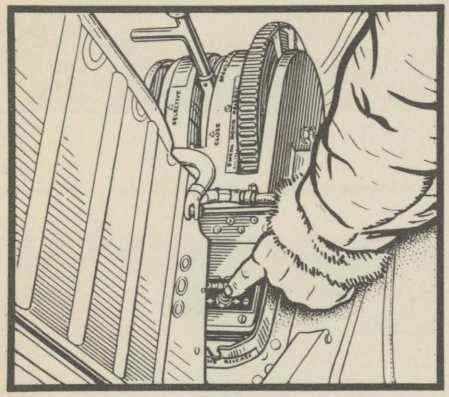


The bombardier, top gunner, two side gunners, and the tail gunner are provided with electric automatic computing sights. Five hundred rounds of ammunition are provided for each gun in the top and bottom turrets. One thousand rounds are provided for each of the tail guns, and two hundred and fifty rounds for a 20 mm. cannon mounted in the tail turret.



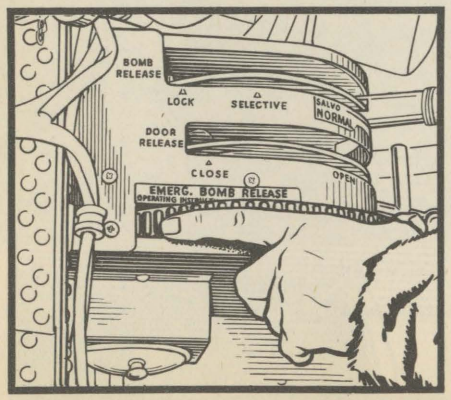


A 16 mm. motion picture camera, shock-mounted to permit operation during gunfire, is located in each turret.



Bomb racks enable the airplane to carry bombs weighing 100, 300, 500, 1000, 1600, 2000, or 4000 pounds.

Automatic electrical release of the bombs is provided for the bombardier.

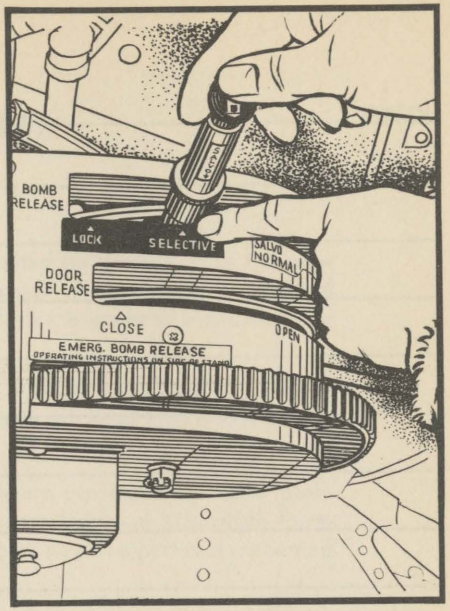


Emergency manual releases are provided at the bombardier's station, the pilot's station and in the aft pressurized compartment.

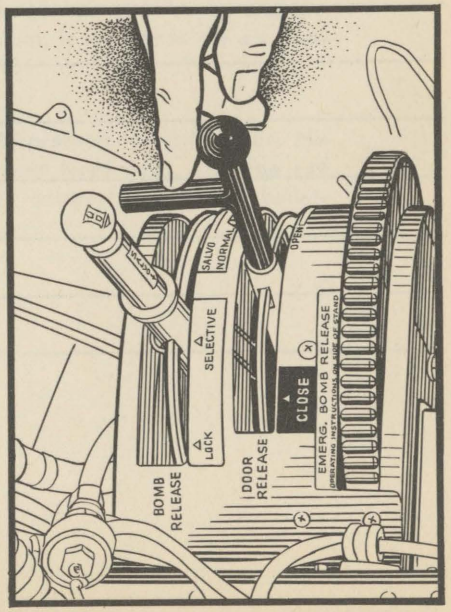
Bombs are dropped unarmed in emergency release.

The bomb release handle, located at the bombardier's station, permits electrical release of bombs when placed in the SELECTIVE position; bombs will be released armed.

When the handle is placed in SALVO position, all bombs will be released mechanically. With nose fusing switch in OFF position, bombs will salvo unarmed.



The controls are so arranged that the bombs cannot be released until the lever controlling the doors has been moved to the OPEN position. Mechanical safety locks prevent use of the bomb release lever before the doors are completely opn. The bombardier has remote control of cameras located in the unpressurized tail section behind the aft pressurized compartment.



NOTES:

ARMOR

Non-magnetic armor plate is installed for protection of the crew and fire-control equipment. Although of light gage, the method of manufacture and manner in which the armor is shock-mounted affords adequate protection.

Behind the pilot's and co-pilot's seats are head high armor plates.

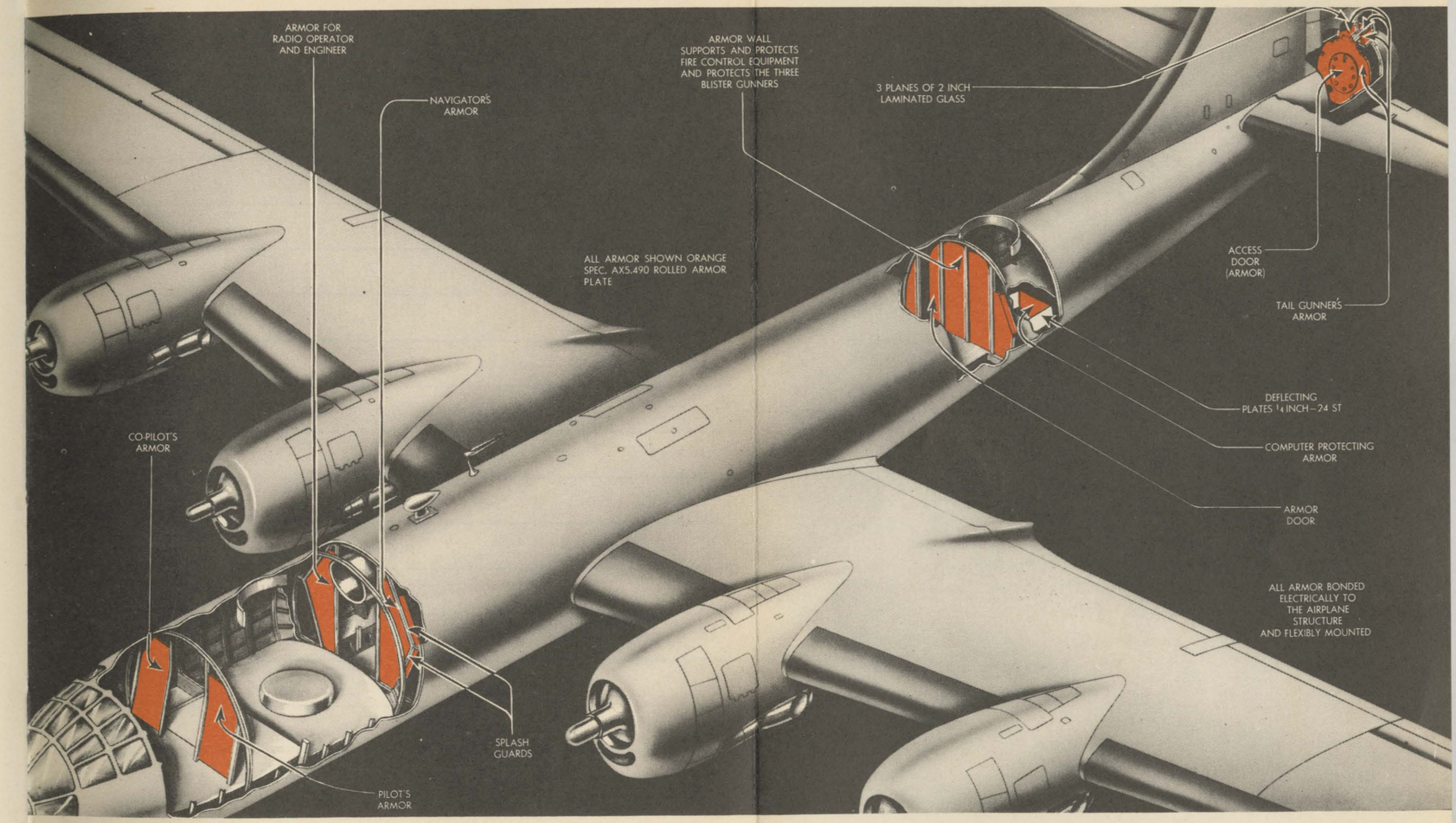
The navigator and radio operator are protected by armor plate mounted on either side of the door in bulkhead 218, which forms the forward wall of the forward bomb bay. The plates are mounted on the aft side of the bulkhead.

For the protection of the two side gunners and the top gunners, a full armor bulkhead, including door, is located in the aft pressurized compartment, at station 706.

An armor bulkhead at station 1144 protects the tail gunner. His sighting mechanism has plates around three sides. The side and rear windows of the tail gunner's compartment are of bullet-proof glass.

LIFT FOR ARMOR PLATE (Page 55)

NOTES:

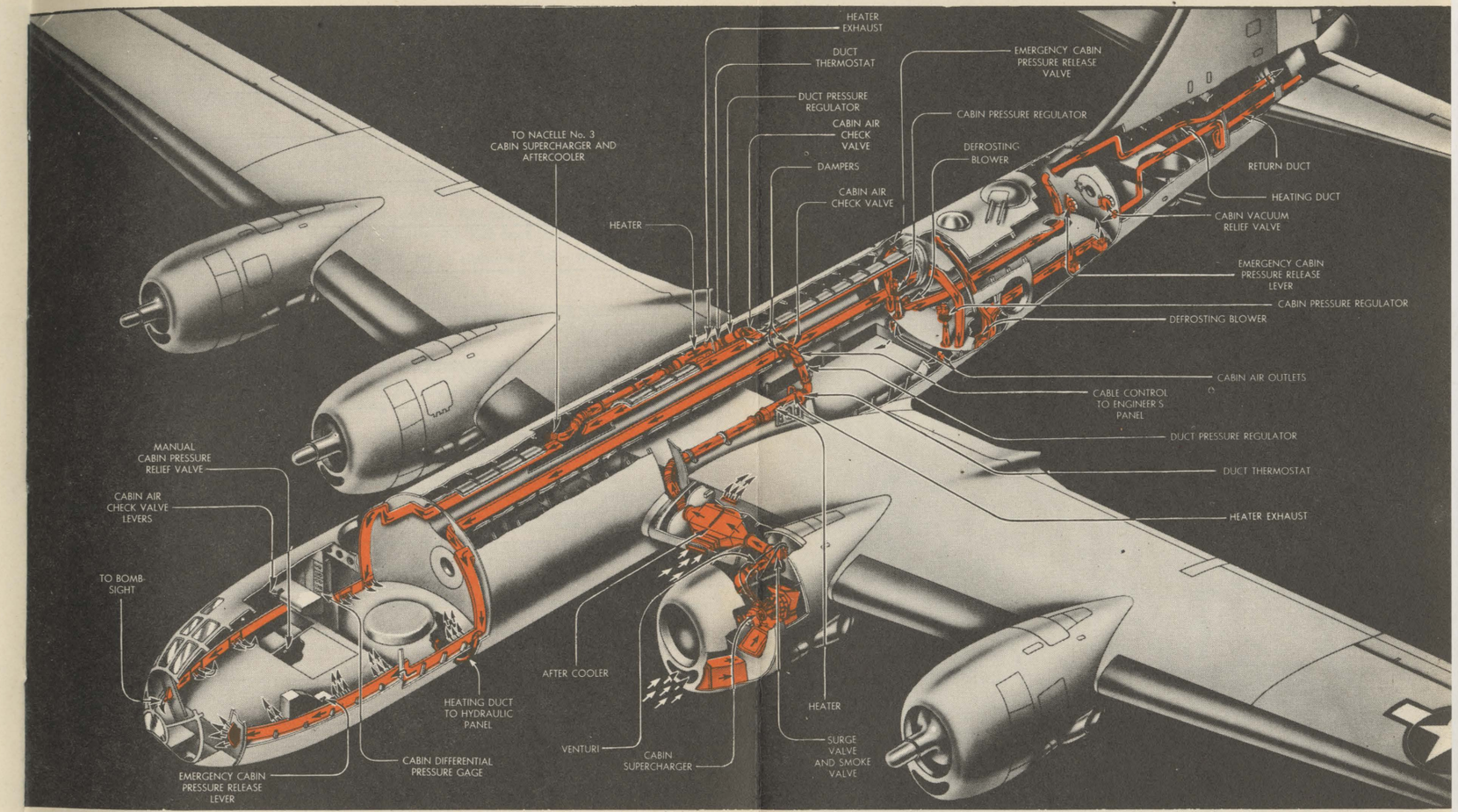


ARMOR PLATE

NOTES:

LIFT FOR CABIN SUPERCHARGING AND HEATING SYSTEM (Page 57)

NOTES:



CABIN SUPERCHARGING AND HEATING SYSTEM

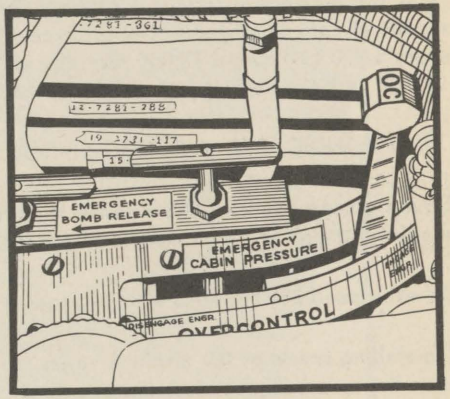
NOTES:

CABIN AIR CONTROL

Control of the air temperature and pressure within the pressurized compartments of the B-29 airplane is automatic. Air is supplied through two independent systems by centrifugal type superchargers powered by engines number 2 and 3. Each supercharger system contains an aftercooler and a gasoline-fired heater, both interdependent and governed by a thermal regulator above the engineer's instrument panel.

No differential pressure is maintained in the crew compartments up to an altitude of 8,000 feet. Pressure equivalent to 8,000 feet altitude (22.22 inches of mercury) is maintained within the compartments from 8,000 feet up to 30,000 feet. From this altitude to 40,000, the cabin differential pressure is equal to 13.34 inches of mercury. Above 40,000 feet, the pressure differential decreases since the superchargers have reached their maximum capacity.

All emergency exits open inward, therefore, cabin pressure must be relieved before these doors will open. Two pull handles operate the EMERGENCY RELEASE valve. One is located on the pilot's control stand and the other on the side wall of the aft pressurized compartment.



NOTES:

FLIGHT LIMITS

The airplane has been engineered to allow an ample margin of safety. However, some maneuvers impose stresses for which the airplane was not designed. The following maneuvers are prohibited:

LOOP	INVERTED FLIGHT
DIVE	IMMELMAN TURN
SPIN	VERTICAL BANK
ROLL	STALL

In such maneuvers, the structure may not fail, but it may be damaged, causing delays for repair and adjustment.

LIMITING SPEEDS:

Near the airspeed indicator a placard shows the permissible indicated airspeeds at various altitudes. Do not exceed 221 mph IAS at 35,000 feet. For every 5,000 feet below 35,000 feet, the indicated airspeed may be increased 10 mph until the limit of 300 mph is reached.

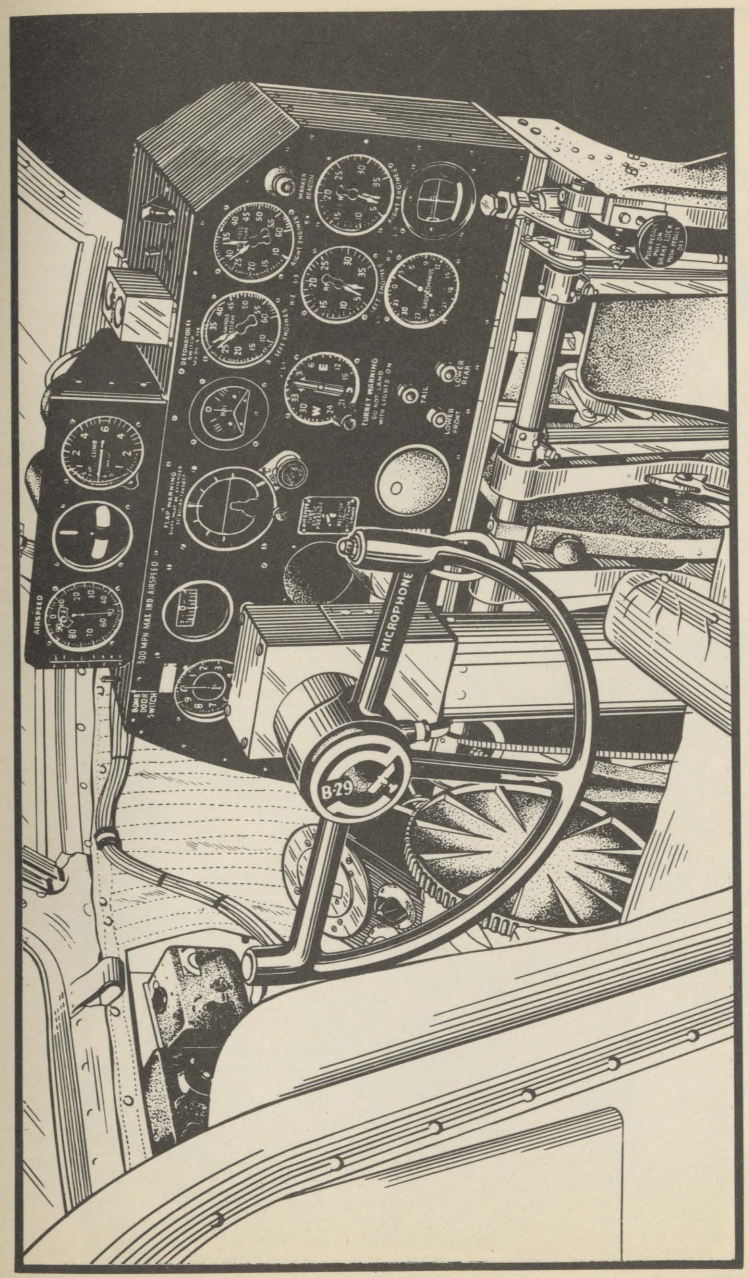
THE INDICATED AIRSPEED SHOULD NEVER EXCEED 300 mph.

Do not exceed 220 mph IAS with the wing flaps extended 20 degrees. Do not exceed 180 mph IAS with the wing flaps fully extended (45 degrees).

Do not exceed 200 mph IAS with the landing gear extended.

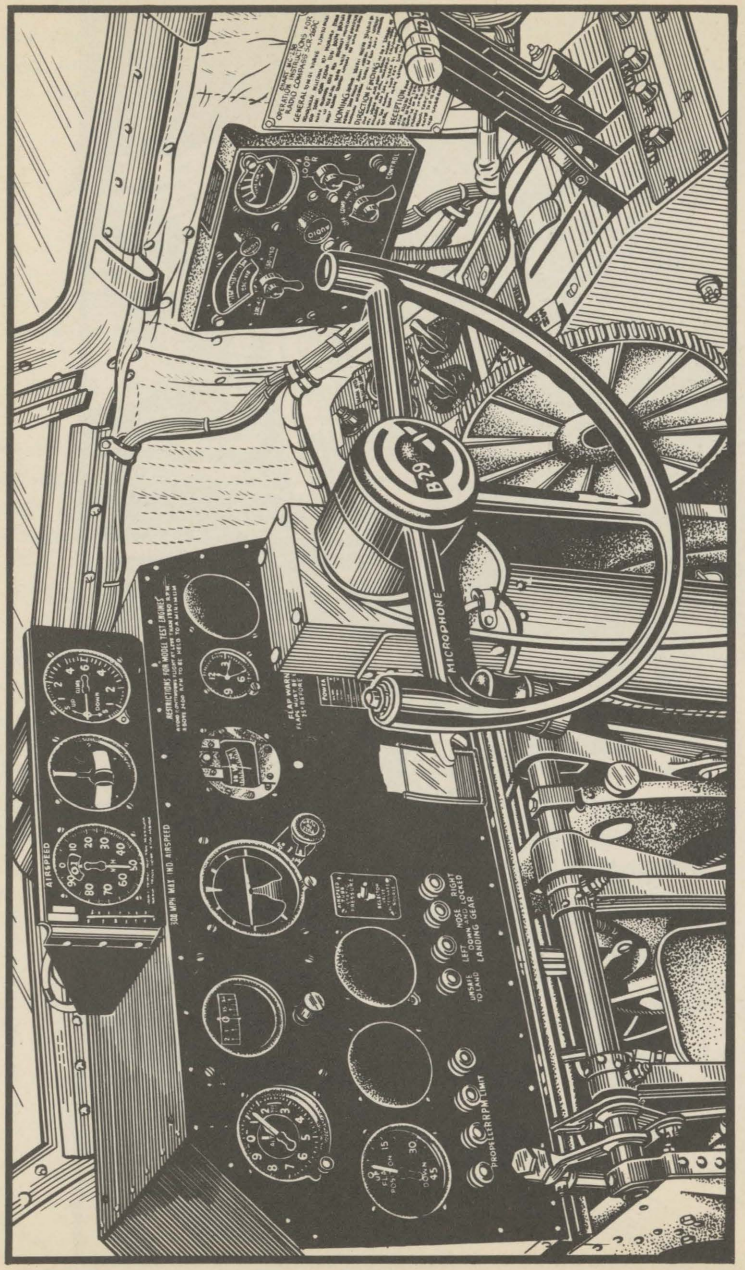
The stalling speed of the airplane varies from 93 to 135 mph IAS depending upon the load being carried, the amount of power used, and the angle of the wing flaps. For stalling speeds at any of the above conditions refer to the table on the pilot's instrument panel.

PILOT'S INSTRUMENT PANEL AND CONTROLS



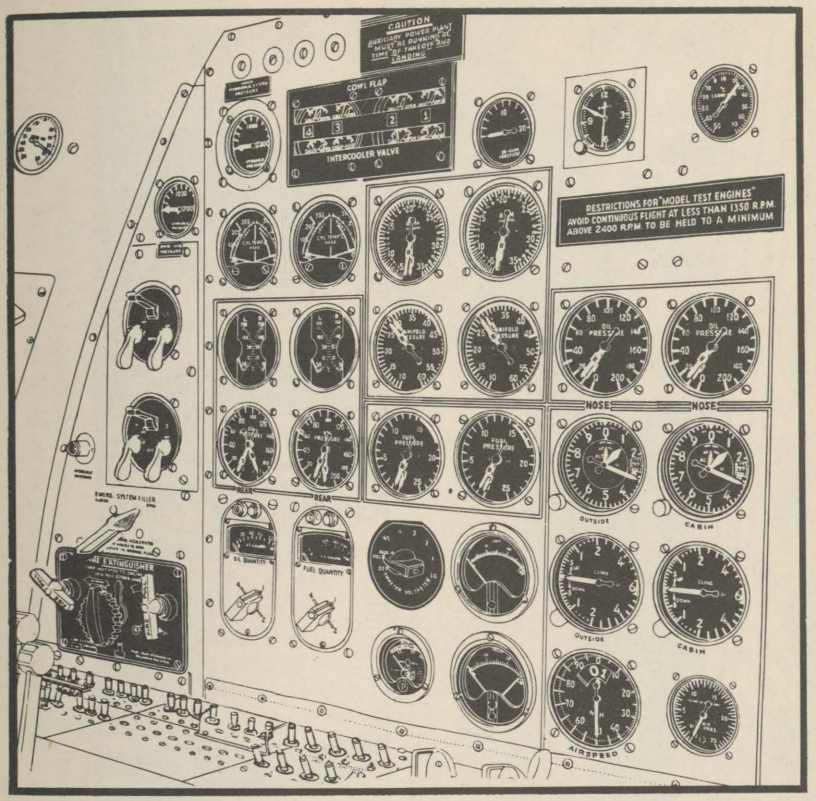
Study the instruments and controls until thoroughly familiar with their locations, purposes, and methods of operation.

CO-PILOT'S INSTRUMENT PANEL AND CONTROLS



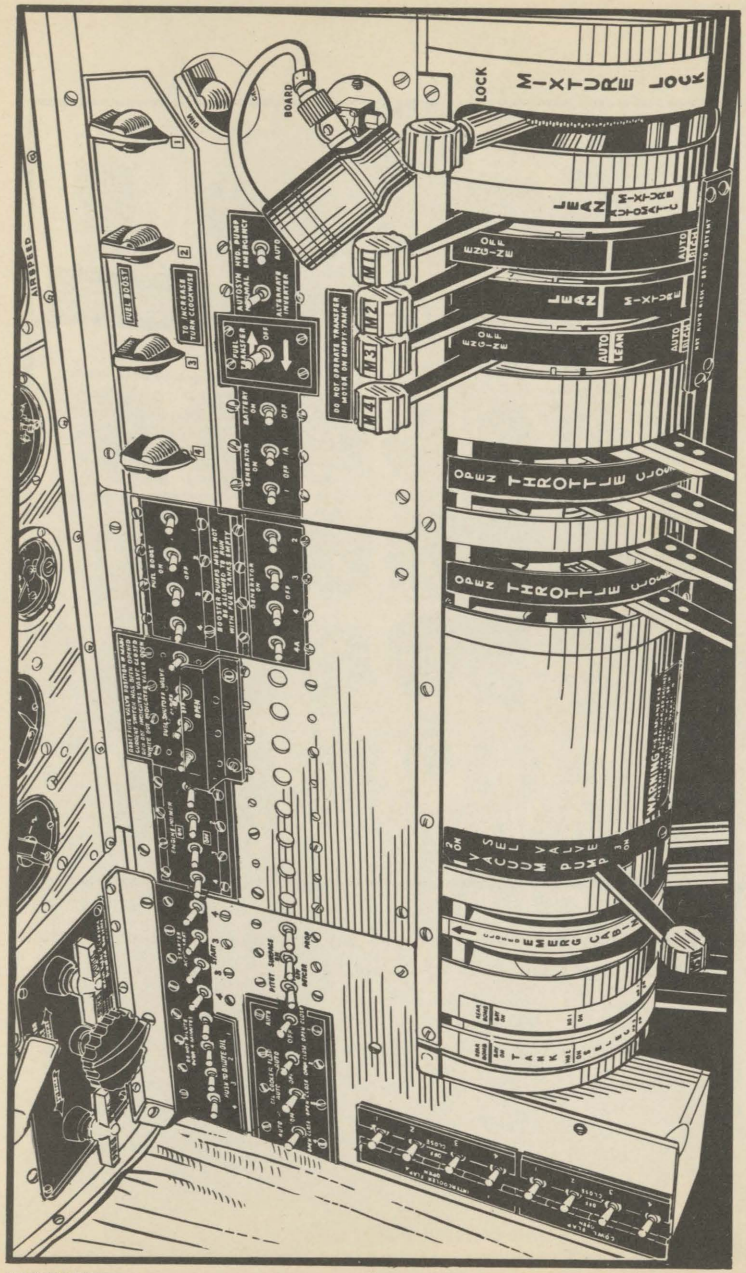
Study the instruments and controls until thoroughly familiar with their locations, purposes, and methods of operation.

ENGINEER'S INSTRUMENT PANEL AND CONTROLS



Study the instruments and controls until you are thoroughly familiar with their locations, purposes, and methods of operation.

ENGINEER'S SWITCH PANEL



The engineer's switch panel is horizontal. It is located between the control levers and the base of the instrument panel. Thoroughly familiarize yourself with the locations, purposes, and methods of operation of all switches.

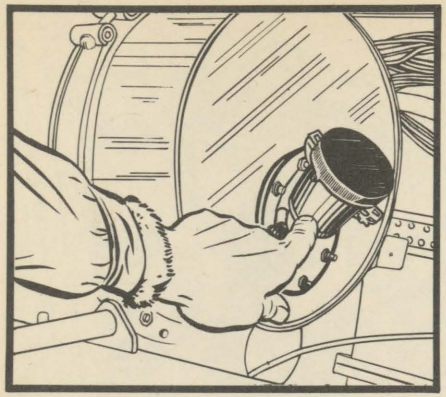
AUXILIARY POWER PLANT CHECK LIST

BEFORE STARTING
- Fuel.
- Oil.
- Emergency switch.

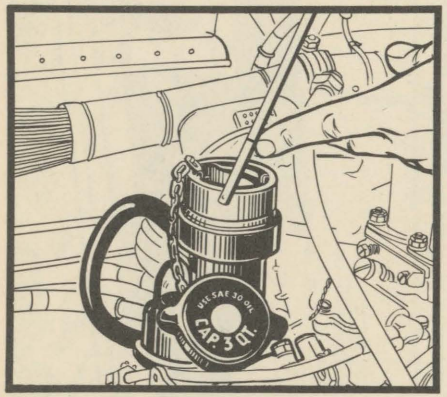
DURING STARTING
- Engine control lever.
- Ignition switch.
- Equalizer switch.
- Generator switch.

AFTER WARM-UP PERIOD
- Engine control lever.
- Generator switch.
- Equalizer switch.
- Oil pressure.

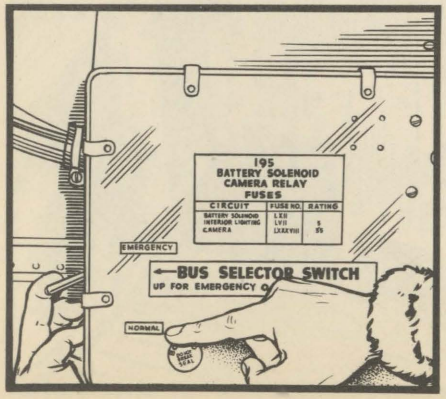
STOPPING
- Generator switch.
- Engine control lever.
- Ignition switch.
- Equalizer switch.



Use 100 octane fuel. The tank should be filled ½ way up in the filler neck.

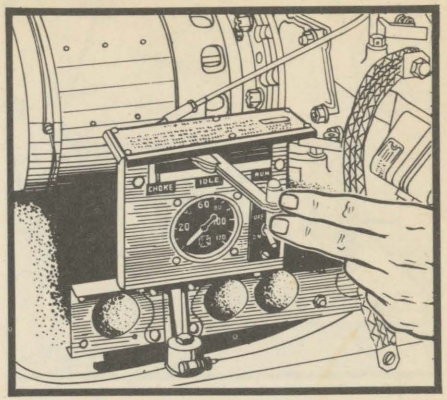


Use SAE 30 oil. The quantity should reach the FULL mark on the gage.

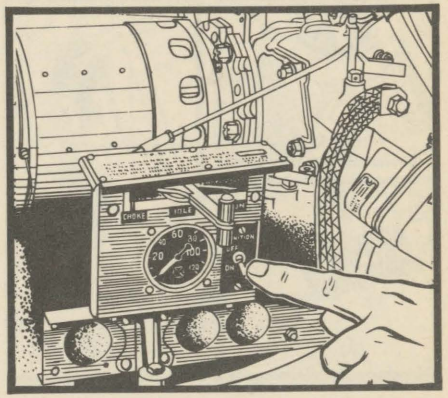


Place the emergency switch in the NORMAL position.

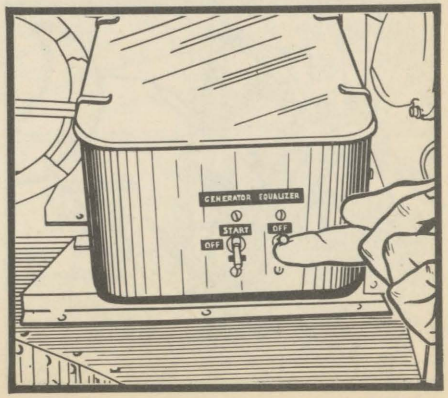
Place the engine CONTROL LEVER to the IDLE position. (If O.A.T. [outside air temperature] is zero degree or less, place in CHOKE.)



Turn the IGNITION switch to the ON position.

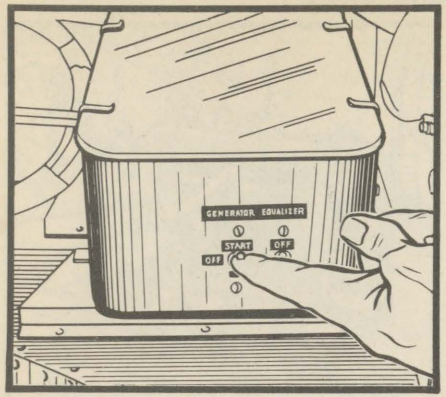


Turn the EQUALIZER switch to the OFF position.

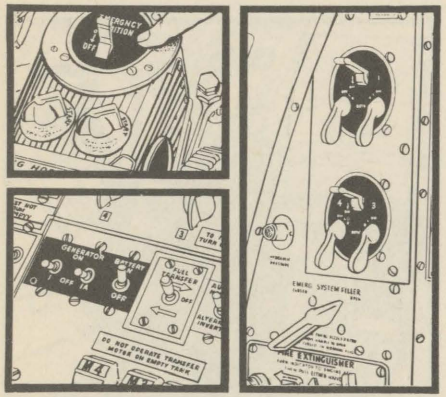


AUXILIARY POWER PLANT

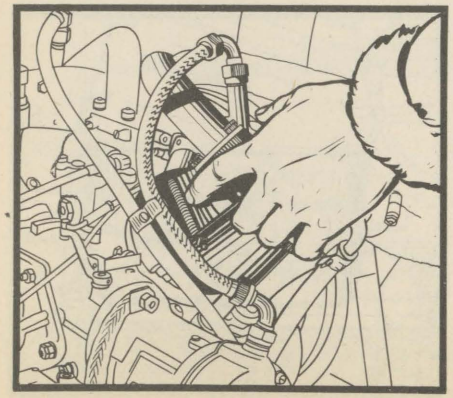
STARTING AND WARM-UP



Hold the GENERATOR switch at the START position until the engine begins to run.



The pilot's EMERGENCY, the engineer's MASTER and the BATTERY switches must be turned to the ON positions.

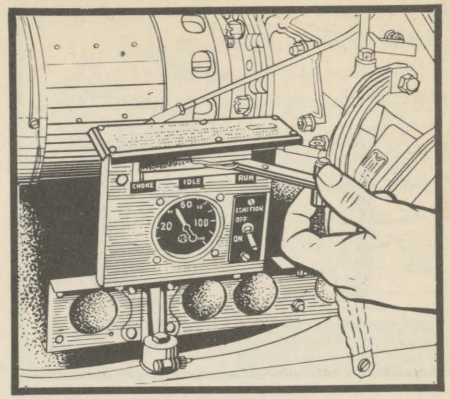


Permit the auxiliary power plant to run 2 to 5 minutes, or until the cylinder baffles become warm.

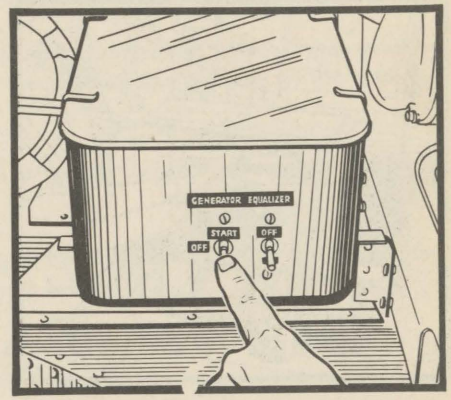
AUXILIARY POWER PLANT

AFTER WARM-UP

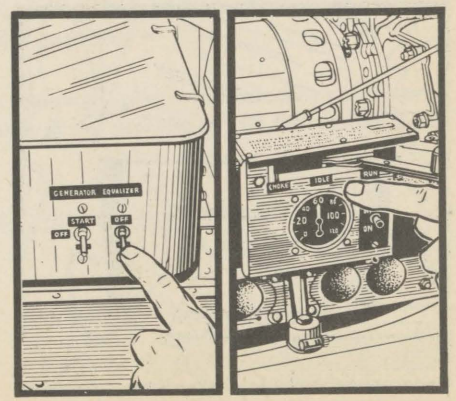
Move the CONTROL LEVER to the RUN position.

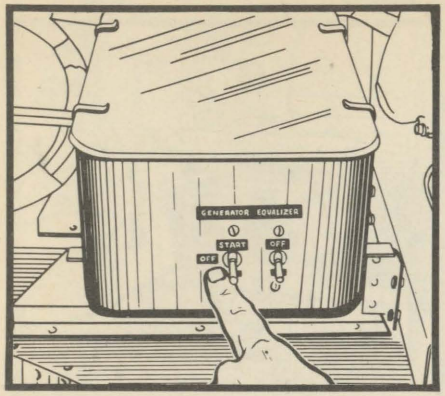


Place the GENERATOR switch in the RUN (or ON) position.

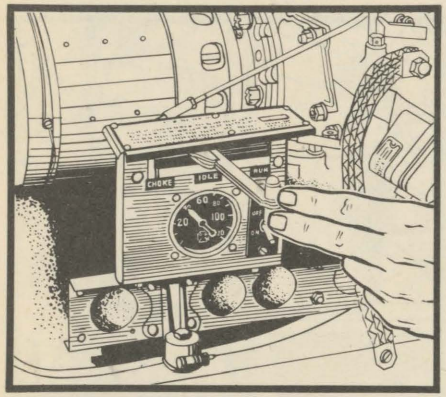


Leave the EQUALIZER switch in the OFF position and turn it to the ON position when the engines are running. Oil pressure limits are 45 to 75 pounds per square inch.

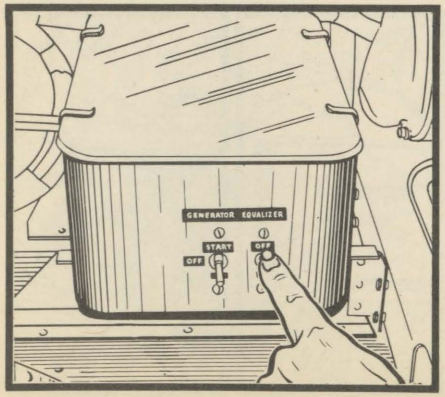




Turn the GENERATOR switch to the OFF position.



Turn the CONTROL lever to the IDLE position. Permit the engine to run 2 or 3 minutes.



Turn the EQUALIZER switch to the OFF position.
Turn the IGNITION switch to the OFF position.

ENGINE DATA

Nose oil pressure	30 to 50 pounds per square inch.
Rear oil pressure	60 to 80 pounds per square inch.
Fuel pressure	15 to 18 pounds per square inch.
Fuel boost pump pressure	14 to 16 pounds per square inch.
Cylinder head temperature	Max. 260 degrees Centigrade.
Oil temperature	55 to 90 degrees Centigrade.
De-icer pressure	7 to 7.5 pounds per square inch.
Vacuum	3.8 to 4.2 inches of mercury.

Nose oil pressure may drop to 5 pounds per square inch during propeller governing.

NOTE: Engines have been operated successfully at 120 degrees Centigrade, but for a short time only. Take-offs should not be made in ranges which cause cylinder head temperatures to exceed 260 degrees Centigrade.

Before take-off, set the cowl flaps to the 15 degree (4½ inch) open position. This is indicated when the pointer reaches the long red line on the cowl flap indicator.

Before the take-off run, set the fuel pump rheostat to its lowest position, or as required to maintain pressure.

Check the magnetos at an engine speed of from 2000 to 2200 rpm. The allowable maximum magneto drop (in rpm) is 100.

Desirable head temperatures are 210 degrees Centigrade or less. Keep the cowl flaps closed as much as possible during flight.

At high altitudes, high oil temperatures may indicate a partially congealed oil cooler if the shutters are in the OPEN position.

Operation of the cabin air pressure regulator valve is indicated by a difference in outside altitude and cabin altitude of not more than 100 feet below 8,000 feet elevation.

CABIN PRESSURE READINGS

OUTSIDE (feet)	INSIDE (feet)
0 to 8,000	Same as outside plus or minus 100
8,000 to 30,000	8,000 plus or minus 100
30,000 to 40,000	8,000 to 12,000, proportional to outside

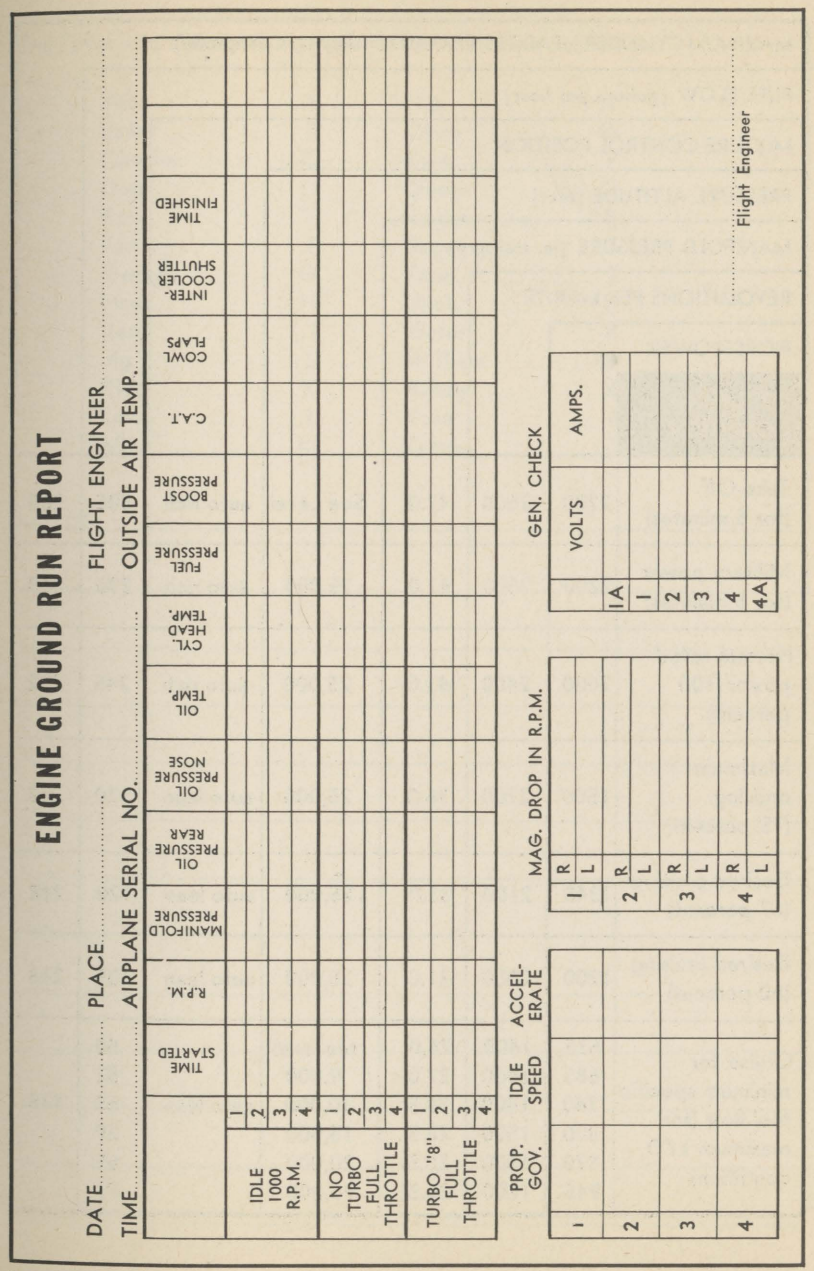
Operating instructions for INTERCOOLER SHUTTER OPERATION are provided for the B-29 airplanes which were built prior to the installation of automatic control units or carburetor air temperature indicators. These instructions were determined from all available flight test data. The full open shutter position is considered to be 15 degrees. These instructions do not apply to airplanes which are equipped with automatic intercooler shutter control units.

INTERCOOLER SHUTTER OPERATION

FLIGHT CONDITION	ALTITUDE	SHUTTER POSITION
All (including take-off)	S.L. to 5,000 feet	Closed
High Speed Level	5,000 to 25,000 feet	1/2 open
High Speed Level	25,000 feet and up	Full open
Climb	5,000 feet and up	Full open
Cruise Level	5,000 feet and up	1/4 open

The above table is intended as a guide only and is secondary to the use of the controls which are necessary to overcome carburetor icing.

High oil temperatures might indicate a congealed cooler if the shutters are in the open position, and the airplane outside temperature is less than zero. To thaw out the cooler, try closing the shutters and the system should return to its normal operating limits.



OPERATING DATA

OPERATING CONDITION	HORSEPOWER	REVOLUTIONS PER MINUTE	MANIFOLD PRESSURE (in. mercury)	PRESSURE ALTITUDE (feet)	MIXTURE CONTROL POSITION	FUEL FLOW (gallons per hour)	MAXIMUM CYLINDER HEAD TEMPERATURE (degrees Centigrade)
Take-Off (for 5 minutes)	2200	2600	47.0	Sea Level	auto rich	305	260
Military power (for 5 minutes)	2200	2600	47.0	25,000	auto rich	290	248
Normal rated power (100 percent)	2000	2400	43.0	25,000	auto rich	245	232
Maximum cruising (75 percent)	1500	2100	36.0	25,000	auto lean	120	218
Desired cruising (67 percent)	1340	2100	33.0	25,000	auto lean	120	218
Desired cruising (60 percent)	1200	2050	31.0	25,000	auto lean	105	218
Cruise for minimum specific fuel flow (for maximum L/D condition)	635 685 740 800 870 945	1400 1400 1400 1500 1600 1700	26.0 27.0 28.5 28.5 28.5 28.5	sea level 9,000 10,000 15,000 20,000 25,000	auto lean	50 52 55 59 65 71	218

MISCELLANEOUS DATA

RADIO OPERATOR

The "phonetic alphabet" equivalents for letters are as follows:

Able	A	Nan	N
Baker	B	Oboe	O
Charlie	C	Peter	P
Dog	D	Queen	Q
Easy	E	Roger	R
Fox	F	Sugar	S
George	G	Tare	T
How	H	Uncle	U
Item	I	Victor	V
Jig	J	William	W
King	K	X-Ray	X
Love	L	Yoke	Y
Mike	M	Zebra	Z

NOTES:

RADIO TIME TICKS

The navigator will rate his time pieces daily by use of the following table:

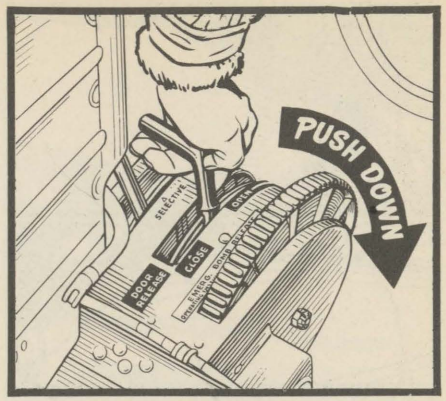
GCT	NSS (ANNAPOLIS)	NPG (MARE ISLAND)	NPH (PEARL HARBOR)	NBA (BALBOA, C.Z.)
0000		115		
0300		115,9090 12540		
0400	113,4390 9425,12630		113,9090 12540	
0500				148,5540 11080
0800		115		
1000	113,4390 9425,12630			
1500		115,9090 12540		
1600	113,4390 9425,12630		113,9090 12540	
1700		115		148,5540 11080
2000		115	113,9090	
2200	113,4390 9425,12630			

—T.O. 08-15-2 July 3, '43

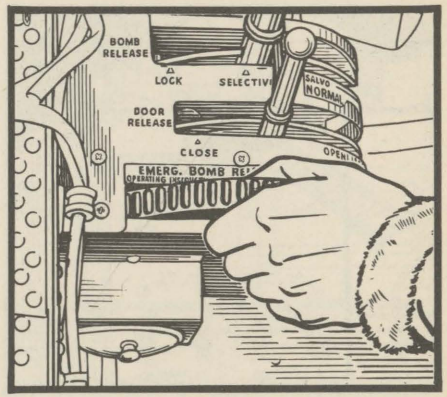
WWV, Washington, D. C., broadcasting on 5000 and 15,000 Kc., sends a continuous time signal. The first minute of every five is silent. The beginning of the second minute to the end of the fifth minute is indicated by a constant tone with a tick in the background.

CHIJ, Ottawa, Canada, sends a constant time tick which is received as a regular time tick every five minutes. Frequencies are 3330 Kc. night, 7735 Kc. day, 14,670 Kc. day and night.

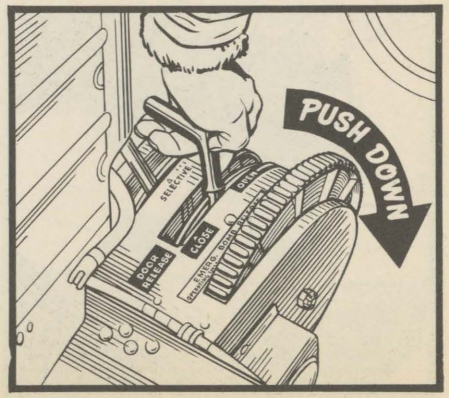
Open and close the BOMB BAY DOORS using the operating switch on the bombardier's control stand.

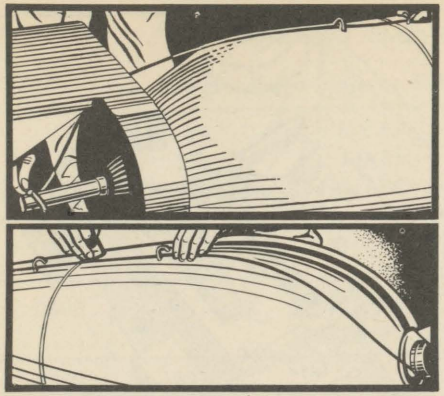


Open the bomb bay doors with the EMERGENCY RELEASE.

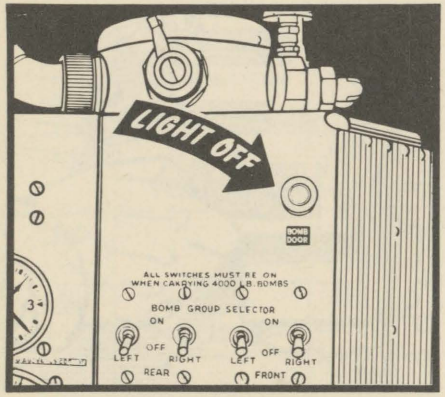


While the motor is running, wait at least 30 seconds before reversing the operation of the bay doors.

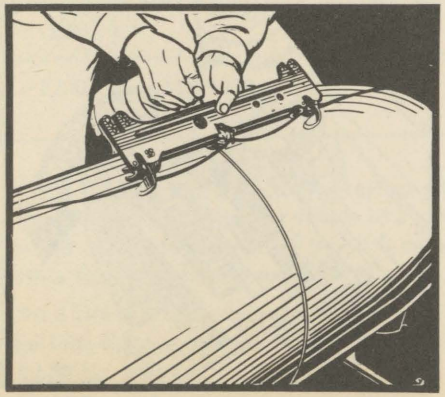




Check each bomb for defects, assembly, and fusing.

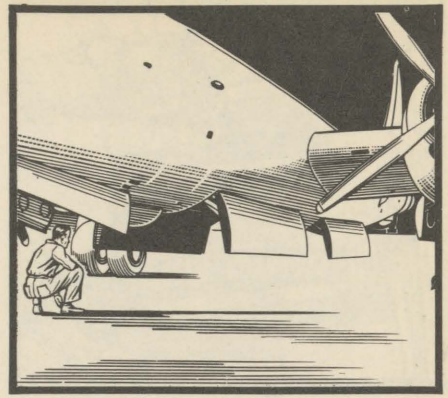


With the bomb bay doors CLOSED, see that the drum at the bombardier's station is rolled in the full counter-clockwise direction, and that the bomb bay door light is OFF.

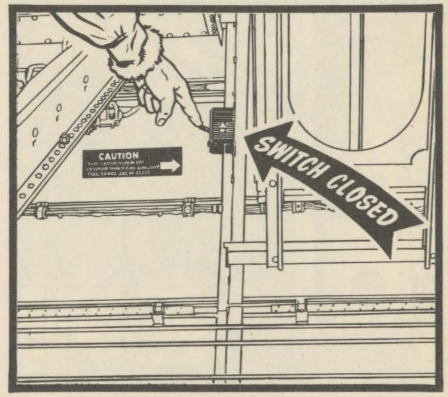


Check the bomb shackles and connect them to the bombs.

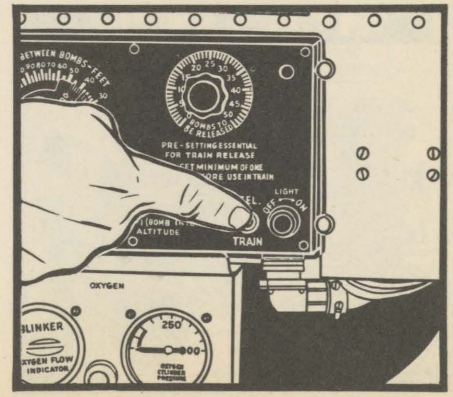
With the bomb bay doors OPEN . . . .

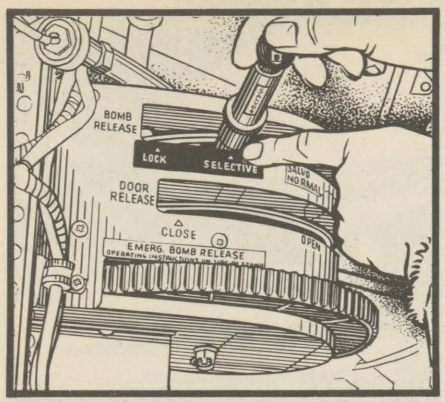


. . . . the TANK SAFETY switch CLOSED (in the ON position)

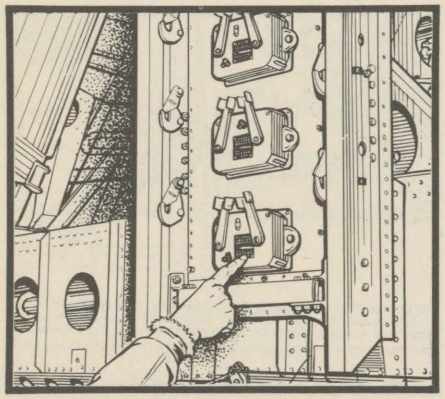


. . . . the INTERVALOMETER at SELECT and . . . .

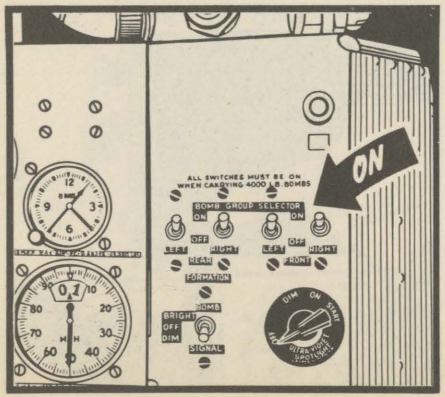




. . . . the ARMING HANDLE in the SELECTIVE position . . . .

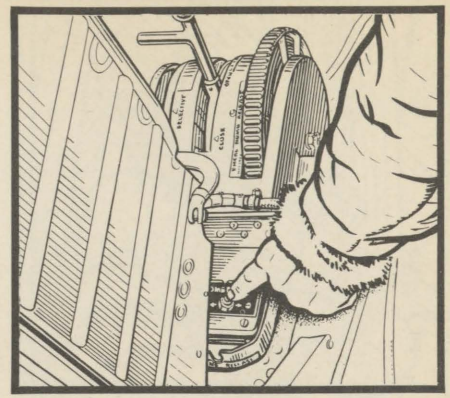


. . . . cock all the RELEASES which are to be used.

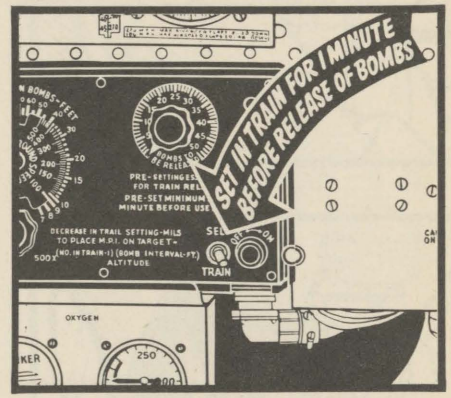


Turn the GROUP SELECTOR switches on the bombardier's panel to the ON position, and . . . .

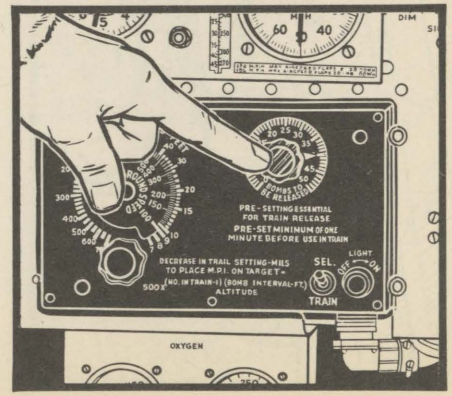
. . . . trip the releases by moving the toggle switch.

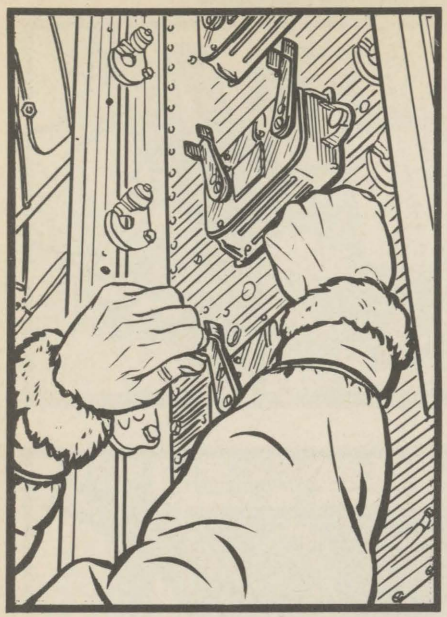


Change the INTERVALOMETER switch to TRAIN.

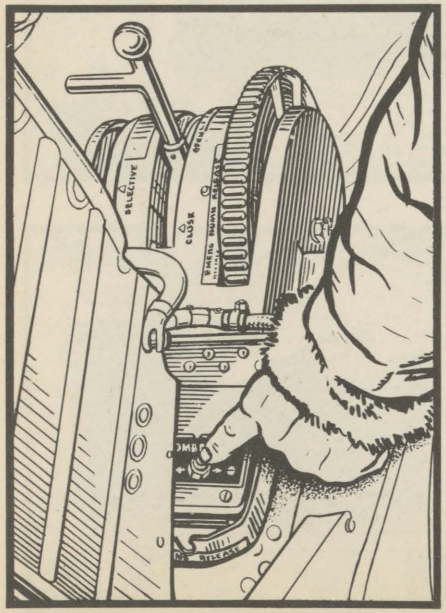


Set the number of bombs on the INTERVALOMETER to correspond with the number of releases to be checked.



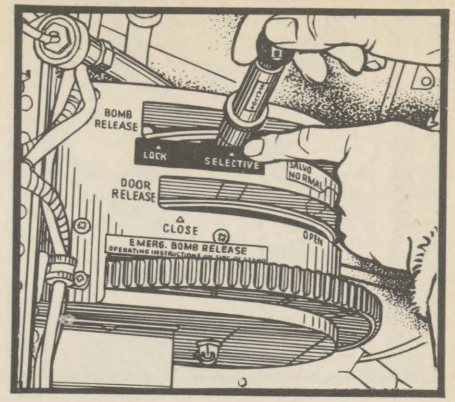


Cock the releases. Wait one minute after setting the number of bombs on the intervalometer.

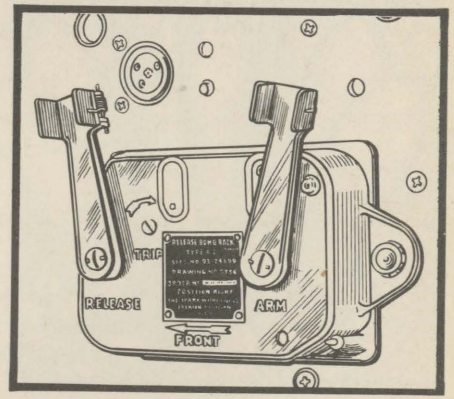


Trip the toggle switch once and all releases will trip in train.

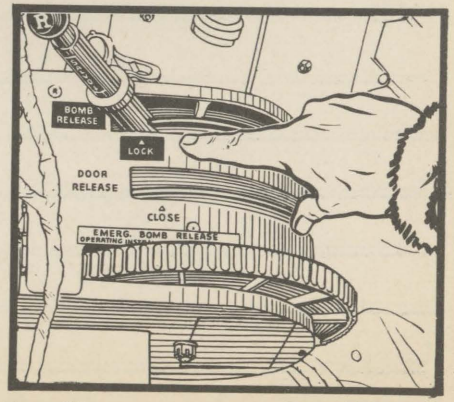
Set the bombardier's ARMING HANDLE in the SELECTIVE position.

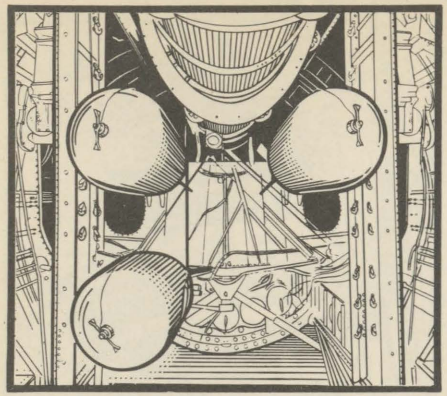


The type A-2 RELEASE UNITS may then be plugged into each active station to be loaded and cocked.

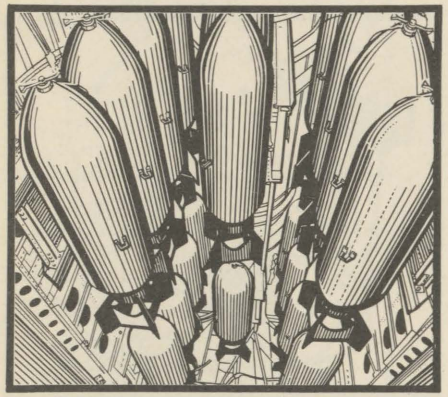


To prevent accidental release of the bombs after attaching the release units, return the bombardier's release lever to the LOCK position.





Load the bomb stations using the airplane's hoisting mechanism.



Before closing the bomb bay doors, inspect all loaded bombs.

NOTES:

Use PA (pressure altitude) in the following formula instead of RE (runway elevation) when PA is used:

BA + TE — RE = Red Result
when
BA = Bombing Altitude
TE = Target Elevation
RE = Runway Elevation
IA = Indicated Altitude

To pre-set the approximate dropping angles and drift, obtain the ground speed from the navigator, or compute it with an E-6-B computer. By using the computer with this data, the ground speed and drift can be estimated for any direction of the bombing approach.

Should difficulty be experienced with the driftmeter, the BOMB SIGHT may be used to compute the drift.

Where dropping angles are not listed for a particular altitude, the dropping angle may be computed by using the following formula:

$$\text{Tangent of dropping angle} = \frac{(\text{G.S.})\ (\text{A.T.F.}) - \text{T}}{\text{Altitude}}$$

When substituting values in the above formula, G.S. must be in feet per second, T must be in feet. Knowing G.S. and WIND VELOCITY, the DROPPING ANGLE and DRIFT may be set into the sight.

NOTES:

MISCELLANEOUS DATA

GUNNERS

The TOP GUNNER is considered to be the GUN COMMANDER. All turrets are under his command at all times. It is his responsibility to designate which turret each gunner will operate.

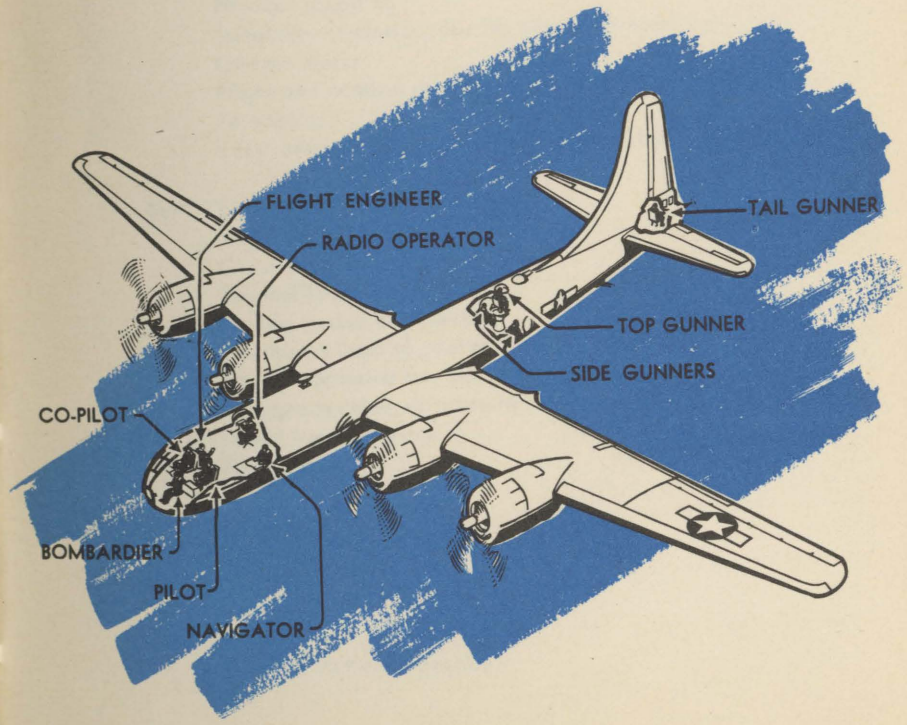
The TAIL GUNNER will operate the AUXILIARY POWER PLANT. In the event he is unable to do so, the top gunner will designate a substitute.

Parachutes will be worn during take-off and until the airplane reaches an altitude which will allow enough time to attach your parachute before bail out.

NOTES:

Section 2

Flight Crew Check Lists and Operating Procedures



PILOT'S AND CO-PILOT'S CHECK LIST

BEFORE ENTERING THE AIRPLANE

A. VISUAL INSPECTION OF THE AIRPLANE

Inflation and condition of tires.
Oleo strut inflation. Leaks and cleanliness of barrels.
Security of engine cowling.
Condition of control surfaces.
Security of inspection plates and escape windows.
Condition of windows.
Removal of pitot tube cover.
Liquid leaks.
Wheel chocks.
Sufficient oil in nose gear shimmying dampener.

B. VISUAL INSPECTION OF THE CREW

Physical condition.
Suitability of clothing for the mission at hand.
Oxygen masks.
Flight and combat equipment.
Parachutes.
Life preservers ("Mae Wests") if required by the mission.

BEFORE STARTING THE ENGINES

Visual inspections.
Crew inspections.
Control lock.
Parking brakes and blocks.
Emergency landing gear release.
Emergency bomb bay door release.
Emergency cabin air pressure release.
Power transfer switch.
Alarm bell.
Engineer's log.
Parachute.
Clothing.
Oxygen.
Life preserver.
Lights.
Combat station inspection.

DURING ENGINE STARTING AND WARM-UP

- Engines.
- Instruments.
- Radio.
- Throttle brake.

BEFORE TAKE-OFF

- Turrets.
- Bomb bay doors.
- Flight controls.
- Trim tabs.
- Hydraulic pressure.
- Vacuum.
- A.F.C.E.S.
- Engine run-up.
- Wing flaps.
- Engineer.
- Crew.
- Windows and hatches.

TAKE-OFF AND FLIGHT

- Landing gear.
- Power.
- Wing flaps.
- Combat stations.
- Auxiliary power plant.

BEFORE LANDING

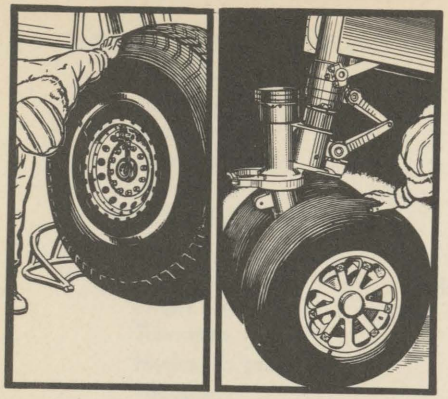
- Order preparation of landing 10 minutes in advance.
- A.F.C.E.S.
- Turrets.
- Engineer.
- Stalling speed.
- Instruments.
- Propellers.
- Turbosuperchargers.
- Gear.
- Wing flaps.
- Trim tabs.
- Throttle brake.
- Airspeed.

DURING LANDING

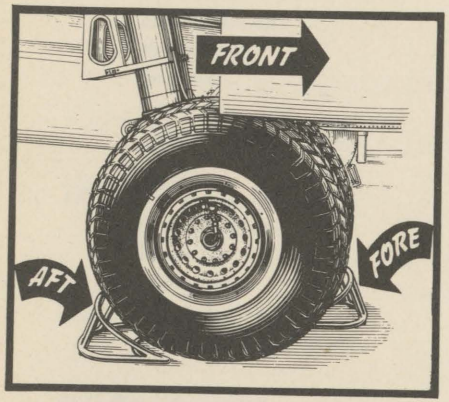
- Airspeeds.

AFTER LANDING

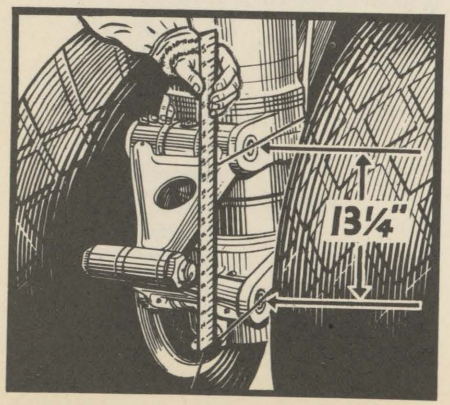
- Turbosuperchargers.
- Propellers.
- Wing flaps.
- Instruments.
- Parking brakes and chocks.
- Switches.
- Control lock.
- Crew inspection.



Visually check the MAIN LANDING WHEEL TIRES for a pressure of 75 to 85 pounds per square inch and the NOSE WHEEL TIRES for a pressure of 45 to 50 pounds per square inch.

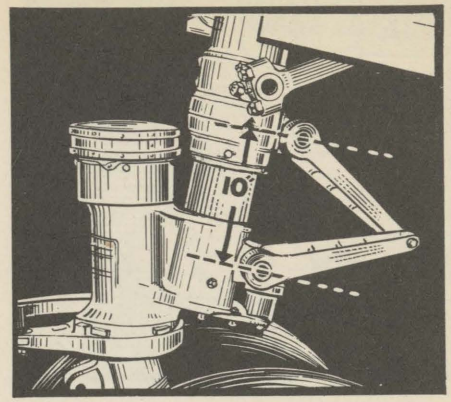


Examine the CONDITION of the TIRES. See that the WHEEL CHOCKS are in place. (In front of the inboard tires and behind the outboard tires.)

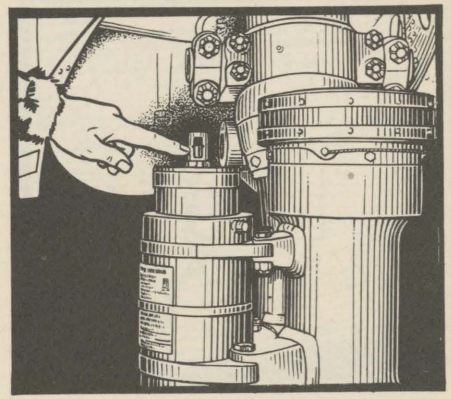


See that the main landing gear OLEO STRUTS have a clearance of 13¼ inches between pin centers and . . . .

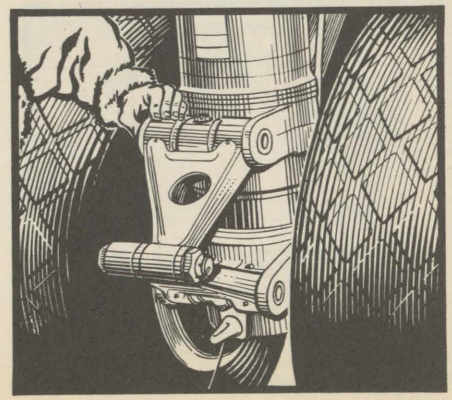
. . . . the NOSE landing gear STRUT has a clearance of 10 inches between pin centers.

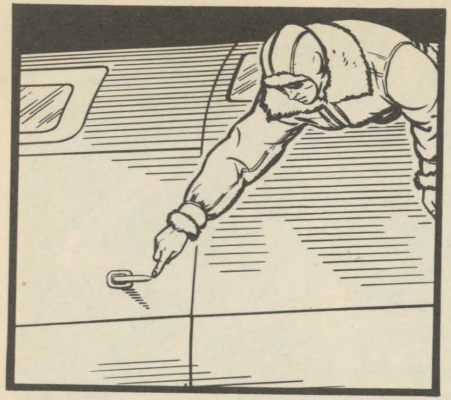


See that the SHIMMY DAMPENER is full.

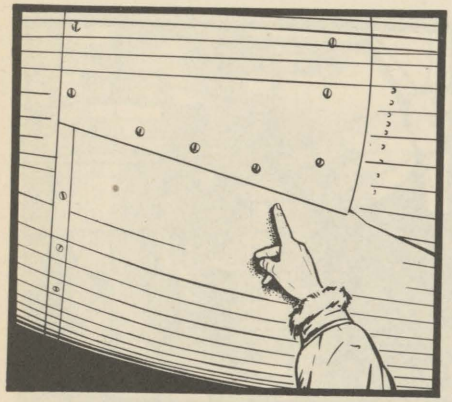


STRUTS must be clean and no leaks should be evident.

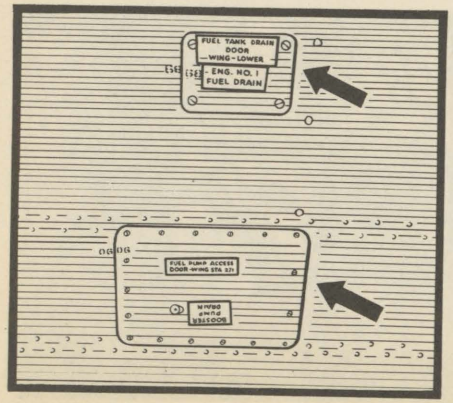




Have the covers removed from the PITOT TUBES.

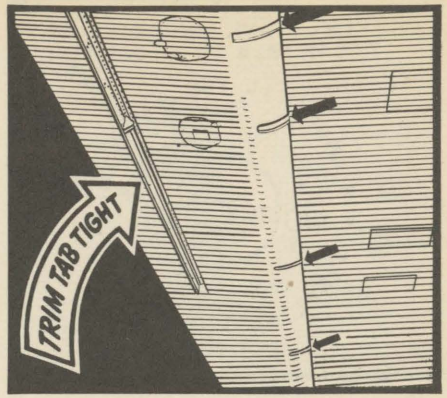


See that all fastenings on the ENGINE COWLINGS are properly secured and . . . .

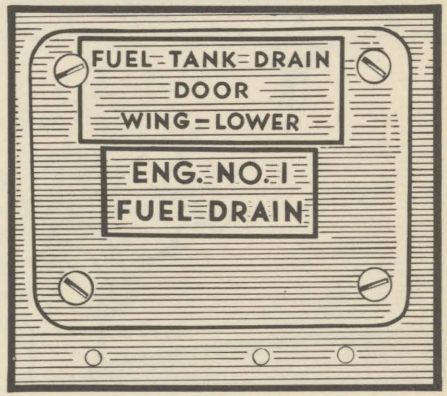


. . . . INSPECTION DOORS are closed and fastened.

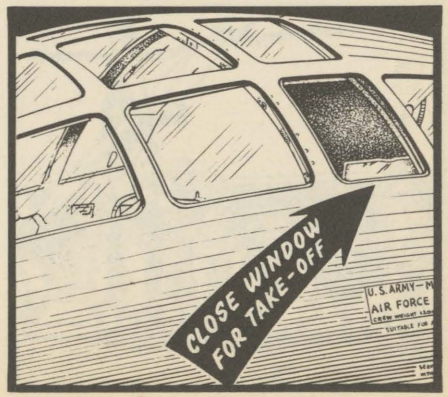
CONTROL SURFACES and TRIM TABS must have no excessive hinge play and should not be dented.

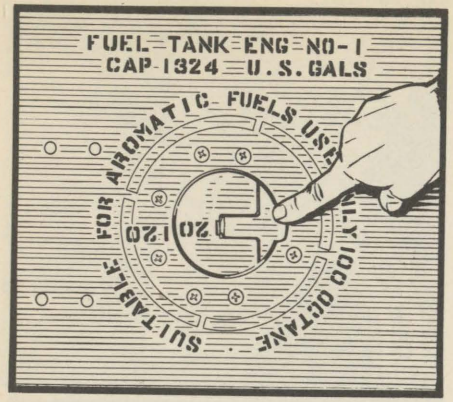


See that the Dzus fasteners on all inspection plates are properly fastened and . . . .

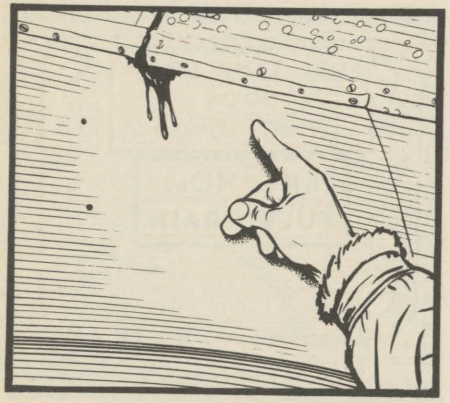


. . . . check all HATCHES and see that they are closed and fastened WINDOWS must be clean and have no cracks.

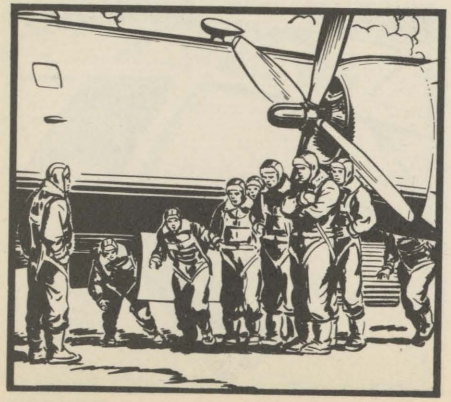




See that the gasoline tank FILLER CAPS are secured in place and . . . .



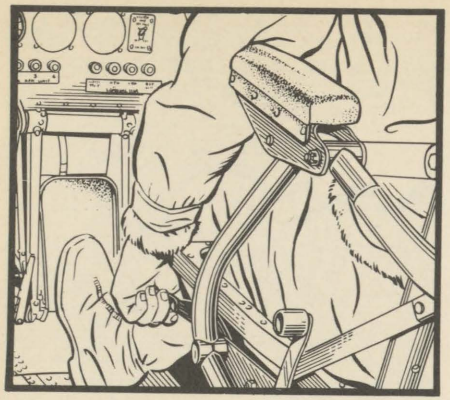
. . . . visually check all CONNECTIONS and seams to make sure there are no fluid leaks.



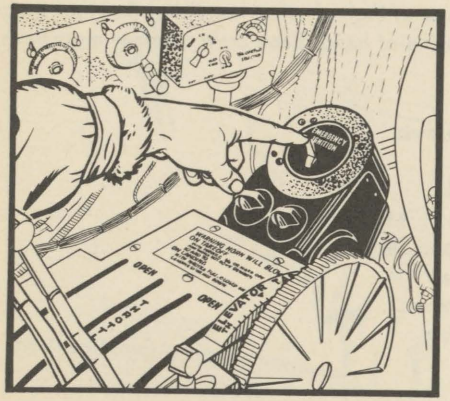
After all the above items have been checked and found to be satisfactory, the pilot will order the crew to ATTENTION for inspection.

Check the crew members to make sure of their physical condition. See that their flight clothing is suitable to the mission at hand. Each crew member must have the following equipment:

Parachute harness
Parachute
Oxygen mask
Life preserver ("Mae West" type)
Pistol, belt, and cartridges
Hunting knife
1 quart of water
Flying clothing



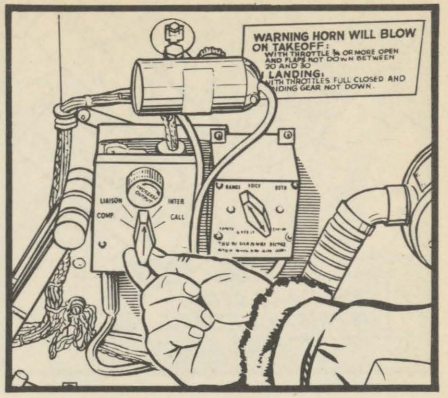
Enter the airplane and adjust your seat.



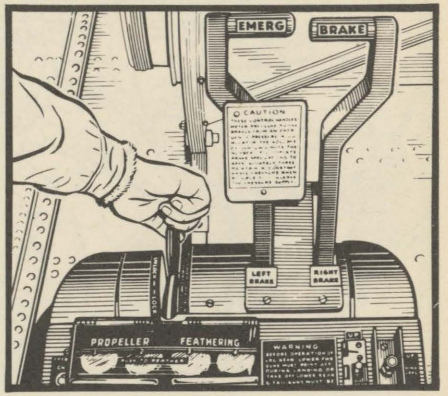
Turn the EMERGENCY IGNITION switch to the ON position.



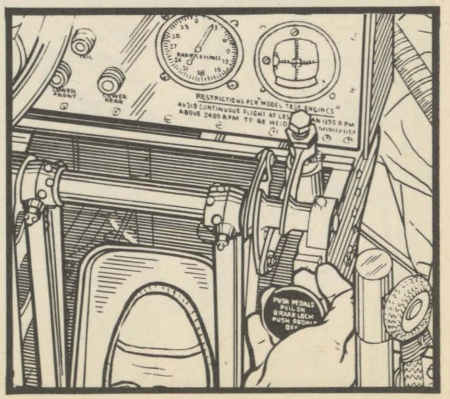
Adjust your EARPHONES and THROAT MICROPHONE.



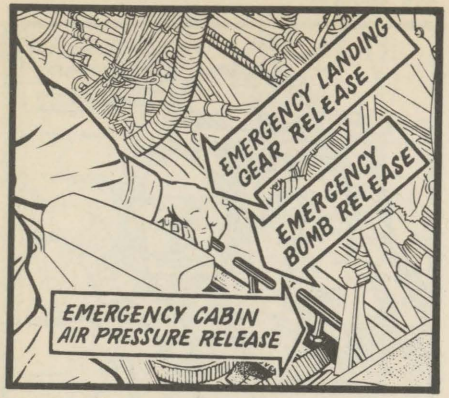
Turn the JACK BOX SELECTOR switch to the COMMAND position. Commands may be given orally to the co-pilot who will transmit them to the crew members.



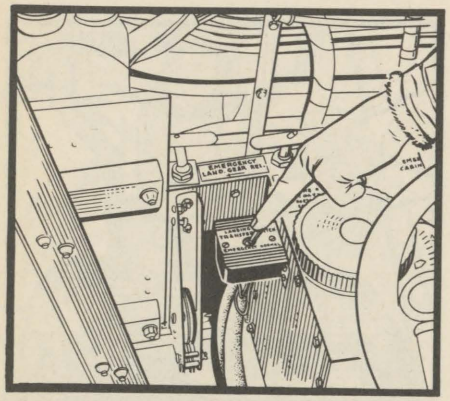
Unlock the control surfaces and throttles by moving the LOCKING LEVER on the aisle stand full forward to the UNLOCK position.



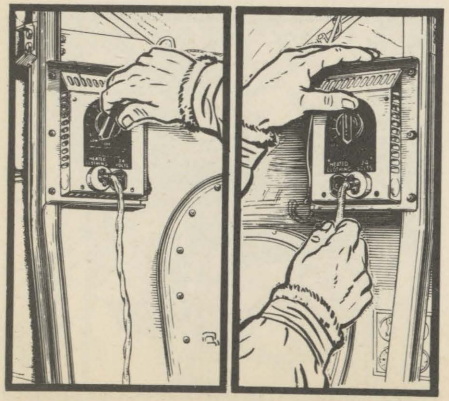
Depress the brake pedals. Pull out the PARKING BRAKE knob to set the brakes.



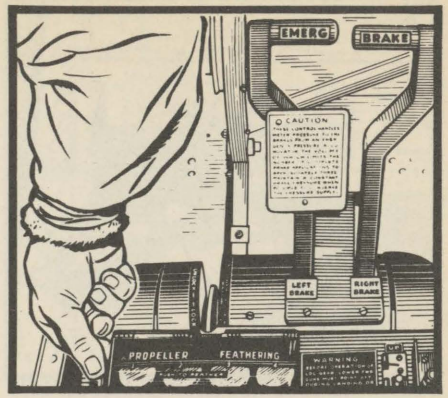
See that the EMERGENCY LANDING GEAR RELEASE, EMERGENCY BOMB RELEASE and EMERGENCY CABIN AIR PRESSURE RELEASE handles on the control stand are properly set.



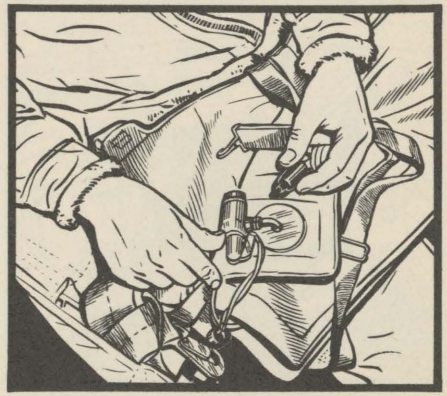
See that the POWER TRANSFER is in the NORMAL position.



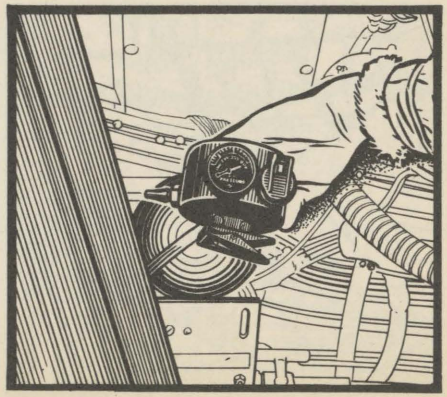
Plug in the connector of your HEATED FLYING SUIT. Be sure that the RHEOSTAT is in the OFF position. Try the various circuits. Be sure that each circuit operates properly and that the elements in your suit supply heat.



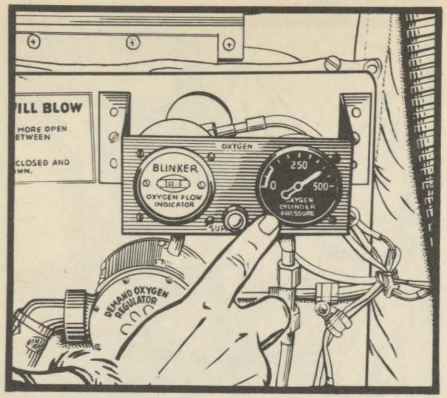
Ring the ALARM BELL. Acknowledge the gun commander's OK.



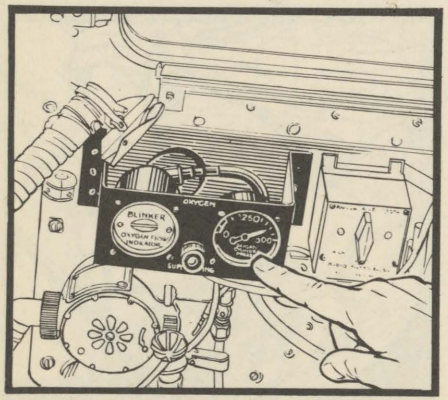
Check the condition of the LIFE PRESERVER and CO_2 cylinder. See that the CO_2 cylinder is not punctured and that the puncturing arm is safetied.



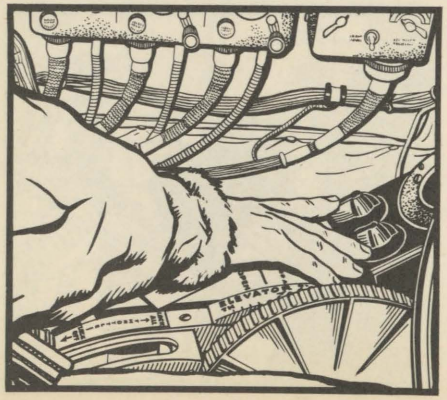
See that a fully charged portable oxygen bottle is within easy reach.



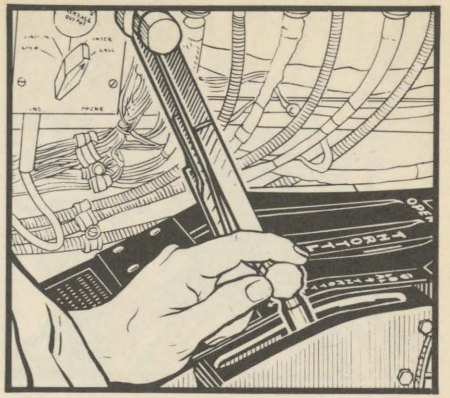
Oxygen pressure should be 400 to 425 pounds per square inch.



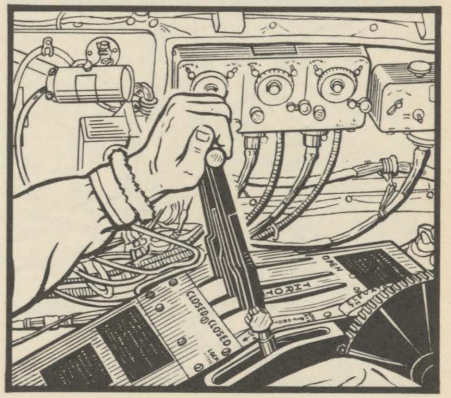
Check the operation of the OXYGEN REGULATOR PANEL.



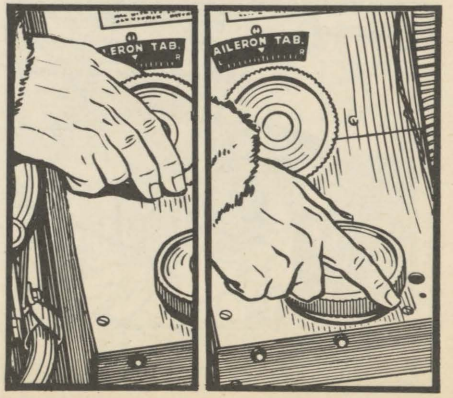
Check the fluorescent lighting and the instrument lights.



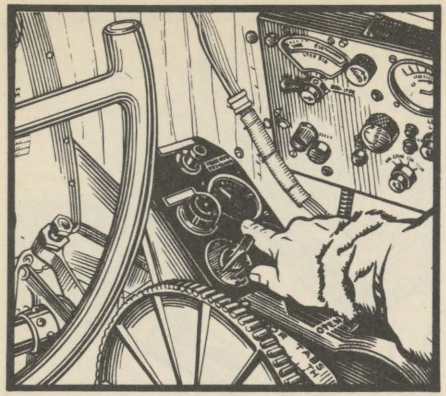
Release the THROTTLE LOCK by setting the locking lever in the LOCK OFF position.



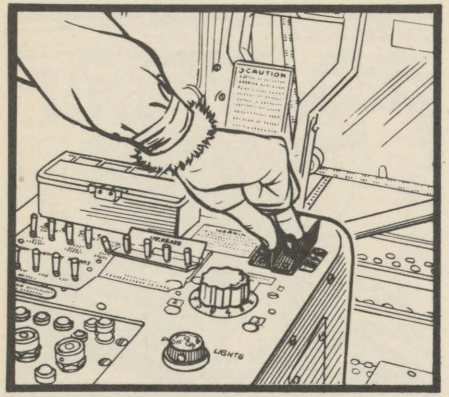
Check the THROTTLES for proper operation through their full range.



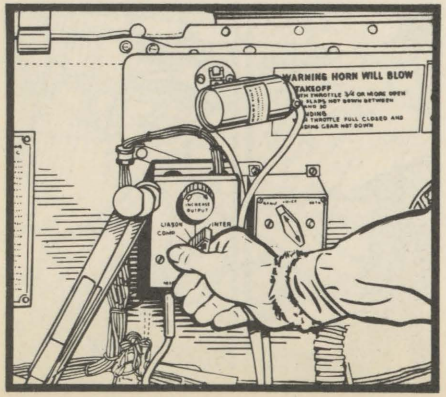
Test the AILERON TAB, ELEVATOR TAB, and RUDDER TAB control wheels for freedom of movement through their full range. Have the top gunner check the movement of the tabs visually.



See that the pressure indicated on the MAIN SYSTEM HYDRAULIC PRESSURE GAGE is between 800 and 1000 pounds per square inch.

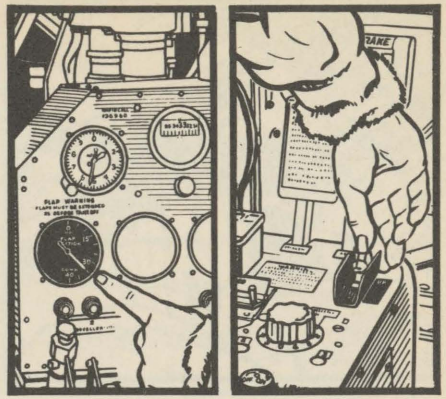


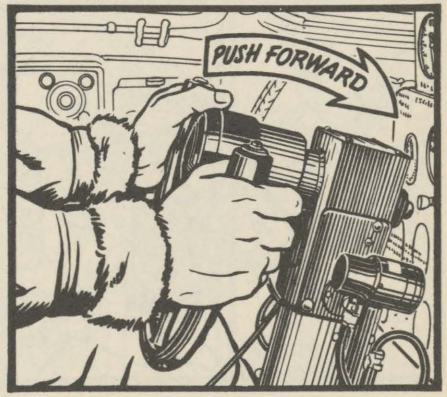
Have the side gunners look at the WING FLAPS to make sure there are no persons or equipment near enough to be in the way when the flaps are lowered. When the gunners signal "ALL CLEAR," lower the wing flaps.



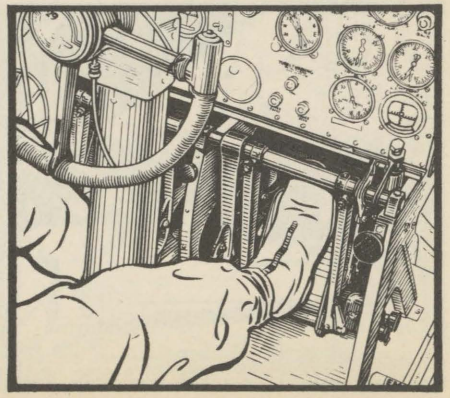
Check over the interphone with the side gunners to see that both flaps are fully DOWN.

Check the operation of the WING FLAP POSITION INDICATOR. Raise the wing flaps. Obtain reports from the right and left side gunners that the flaps are fully UP.

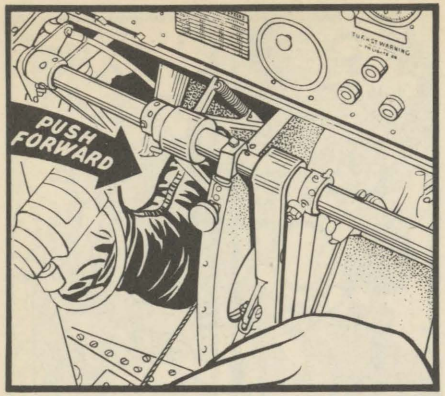




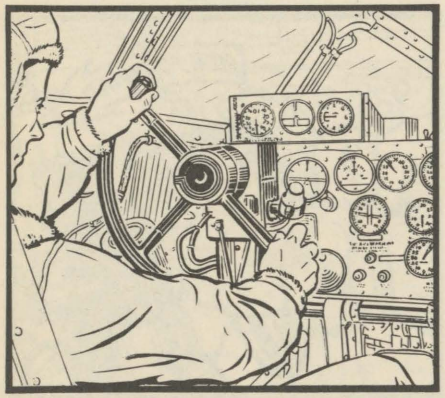
Push the CONTROL COLUMN fully forward to depress the ELEVATORS. Get a report from the top gunner that the elevators are DOWN. Pull the CONTROL COLUMN fully backward to raise the ELEVATORS. Get a report from the top gunner that the elevators are UP.



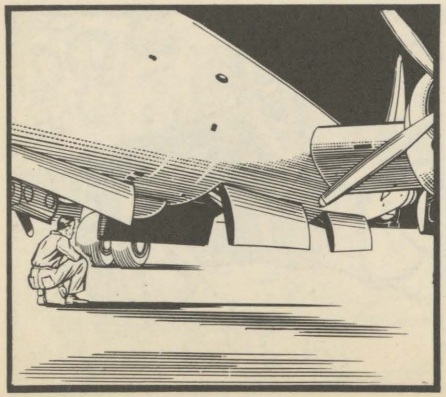
Push the right RUDDER PEDAL fully forward. Obtain a report from the top gunner that the rudder has moved all the way to the RIGHT.



Push the left RUDDER PEDAL fully forward. Obtain a report from the top gunner that the rudder has moved all the way to the LEFT.

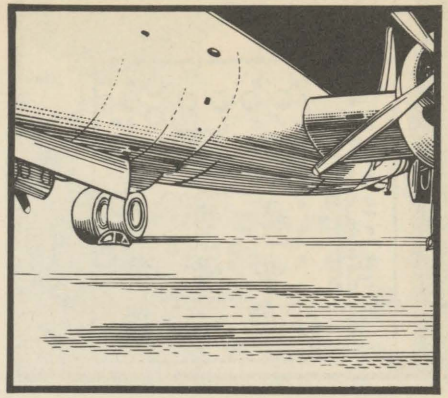


Turn the CONTROL WHEEL fully to the LEFT and obtain reports from the side gunners that the left AILERON is fully UP and the right AILERON is fully DOWN. Turn the CONTROL WHEEL fully to the RIGHT and obtain reports from the side gunners that the right AILERON is fully UP and the left AILERON is fully DOWN.

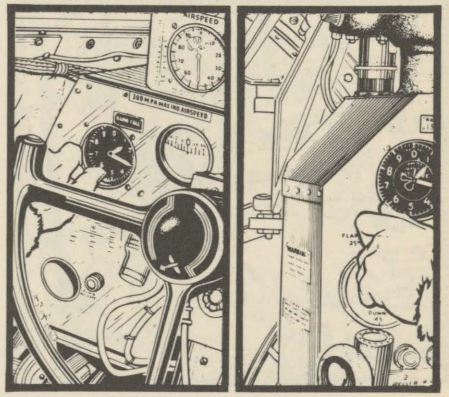


Have the ground crew see that there are no obstructions under the airplane. Order the bombardier to close the BOMB BAY DOORS. NOTE: The bomb bay doors will ordinarily remain open when the airplane is on the ground

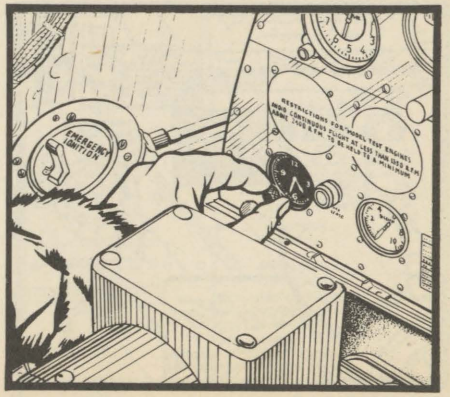
Obtain a report from the ground crew that the bomb bay doors are fully closed.

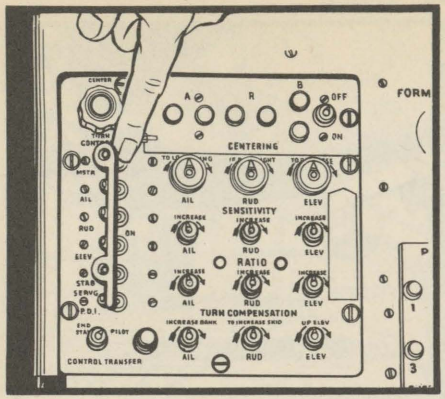


Call the field tower and ask for the BAROMETRIC PRESSURE. Set the ALTIMETERS according to the information received.

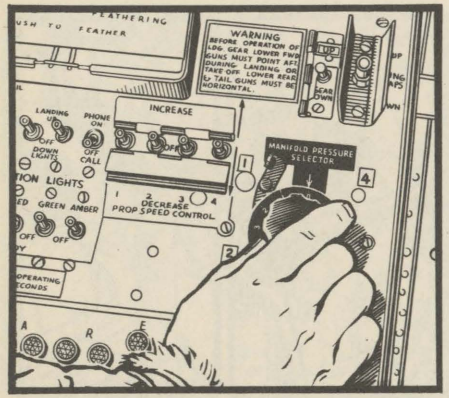


Synchronize the airplane CLOCK with the navigator's chronometer.

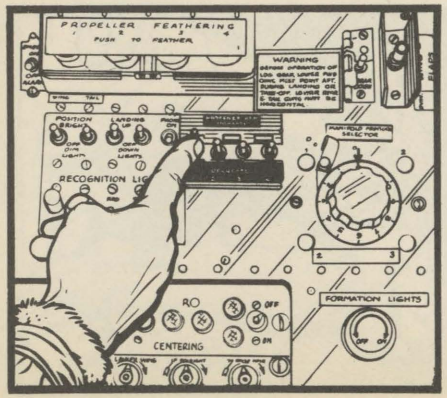




See that the A.F.C.E.S. master switch is in the OFF position.

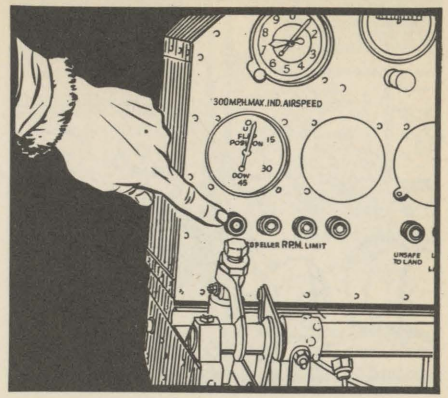


Set the TURBOSUPER-CHARGER knob to the zero position.

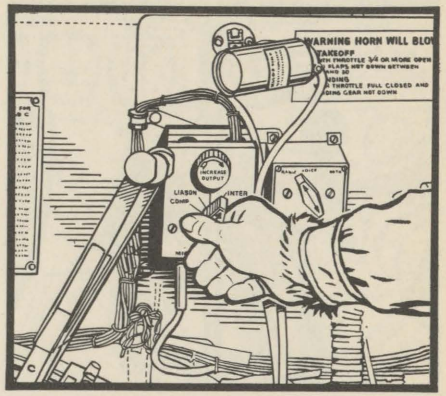


Successively depress each PROPELLER LIMIT switch to INCREASE until . . . .

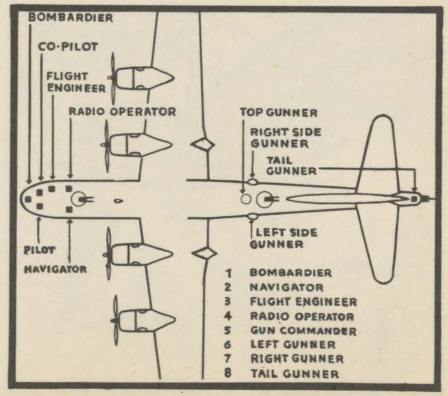
. . . . the lights on the co-pilot's instrument panel FLASH.



The co-pilot will check the status of crew members' "Before Starting the Engines" section of the check lists, and will examine the accuracy of the flight engineer's CENTER OF GRAVITY location chart, flight log, and Form 1.

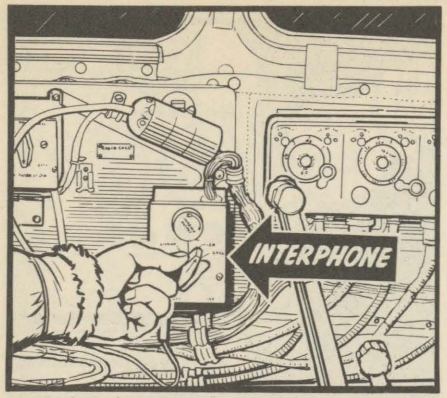


Each crew member will report to the co-pilot in the following order when their "Before Starting the Engines" check has been completed: bombardier, navigator, flight engineer, radio operator, gun commander, left gunner, right gunner, and tail gunner.
The co-pilot will transmit this report to the pilot.

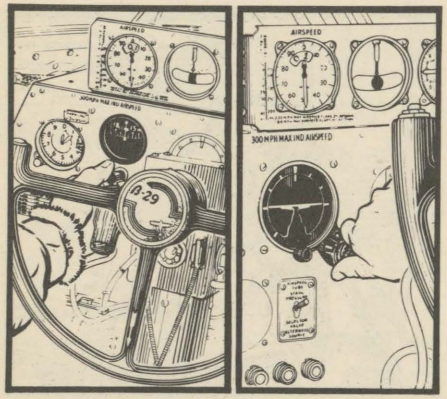


BEFORE STARTING THE ENGINES

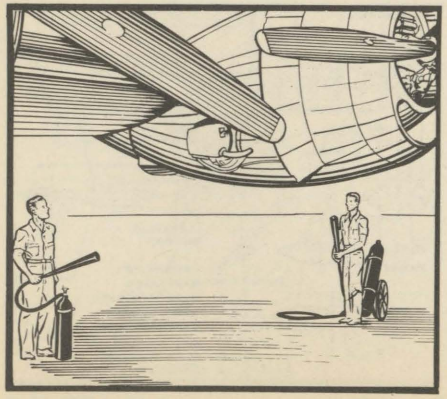
PILOT AND CO-PILOT



The pilot will ascertain that the flight engineer is ready to start the engines and will issue a command over the interphone to "Stand by to start engines."



Cage all GYRO instruments.

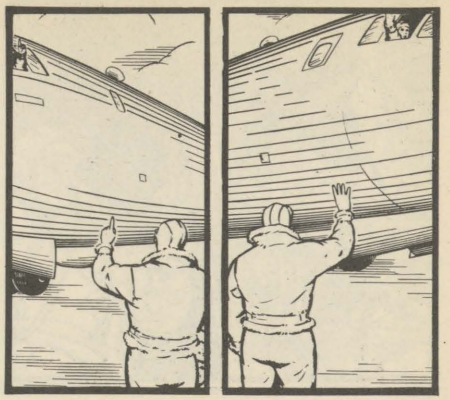


CAUTION: See that firemen with extinguishers are standing by each engine before starting. See that all personnel are clear of the propellers.

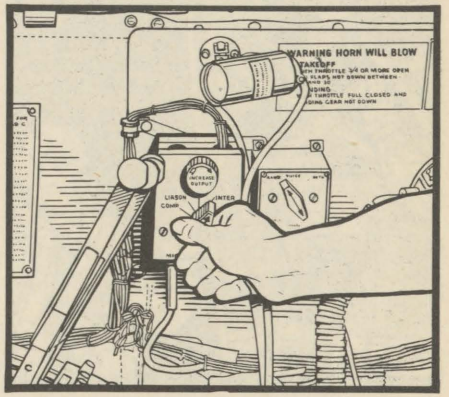
DURING ENGINE STARTING AND WARM-UP

PILOT AND CO-PILOT

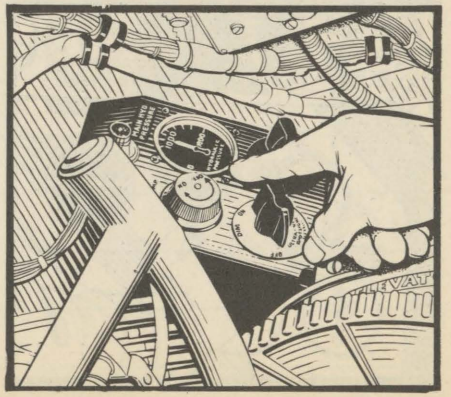
The pilot will hand-signal to the ground crew chief when ready to start engines number 1 and 2. The co-pilot will hand-signal to the ground crew chief when ready to start engines number 3 and 4.

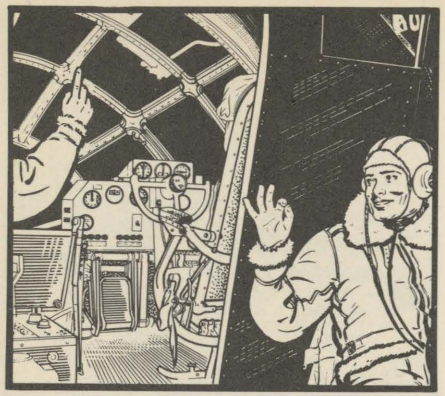


The co-pilot will inform the pilot when all the crew members have completed the "Before Starting the Engines" section of their check lists.

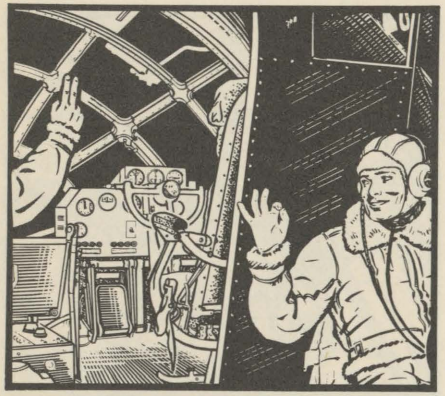


The co-pilot will inform the pilot when the hydraulic pressure is between 800 and 1000 pounds per square inch.

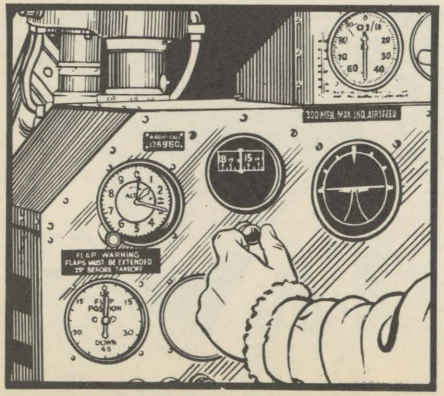




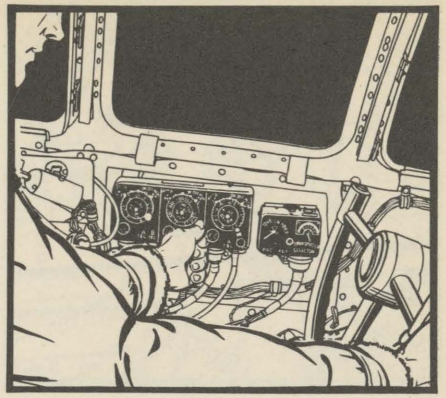
The pilot will order the flight engineer to start engine number 1.



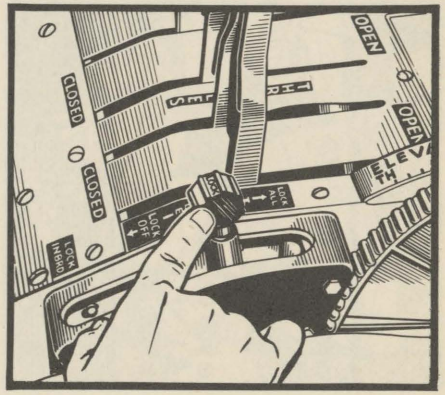
When the flight engineer reports that the first engine started is operating properly, the pilot will order engine number 2 started. The same procedure will be followed for engines number 3 and 4.



The co-pilot will uncage and set all gyro flight instruments.

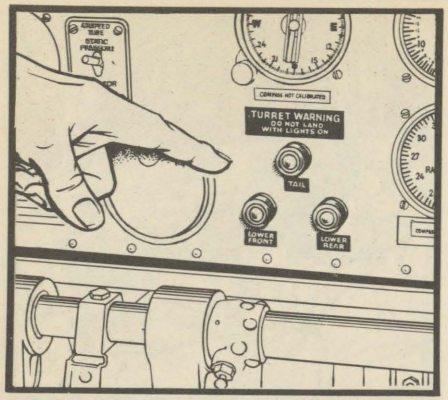


Call the tower on the COMMAND RADIO for instructions from the higher echelon of command.

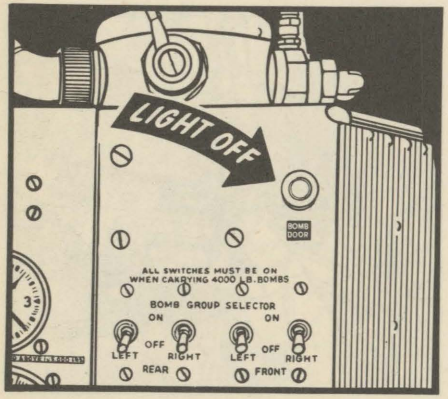


Adjust the THROTTLE LOCK until the tendency of the throttles to creep is overcome. See that all engines are running in synchronization and are operating normally.

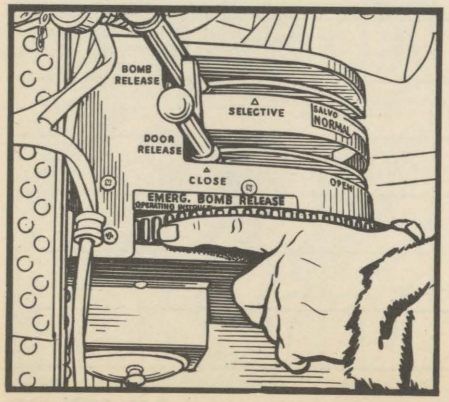
NOTES:



Before taxiing, be sure that the TURRET warning lights are OFF.

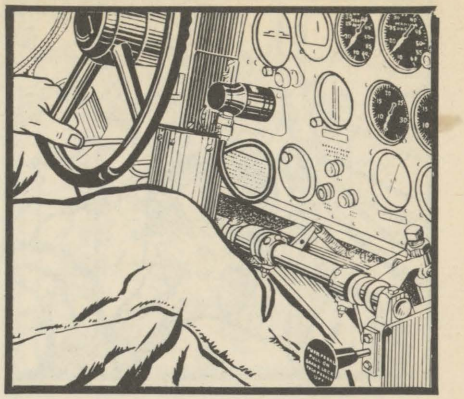


Ascertain that the BOMB DOOR light is OFF.

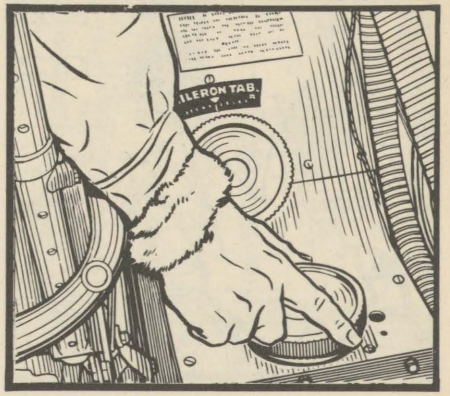


Check with the bombardier to see that DRUM WHEEL at his station is turned to the full counter-clockwise position.

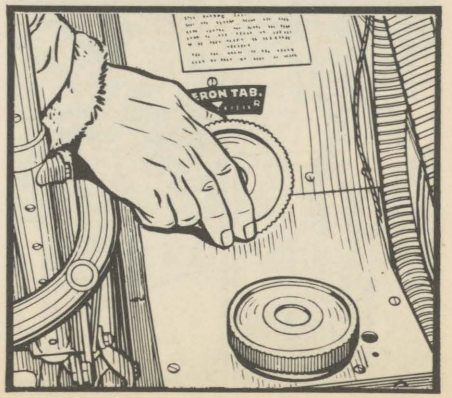
Check all flight controls for freedom of movement. Have the top gunner report on the movements of the CONTROL SURFACES.

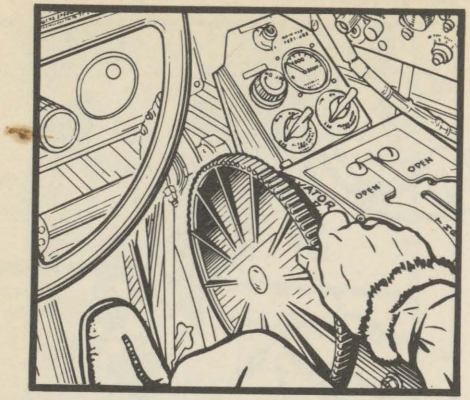


Set the RUDDER TRIM TAB control in NEUTRAL.

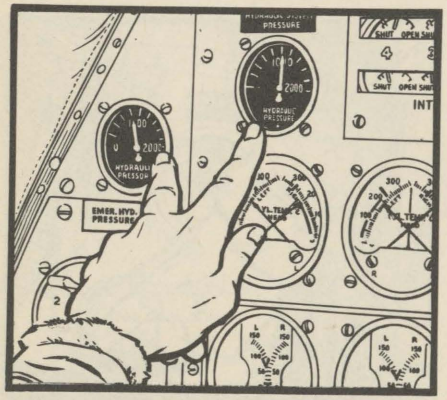


Set the AILERON TRIM TAB control in NEUTRAL.

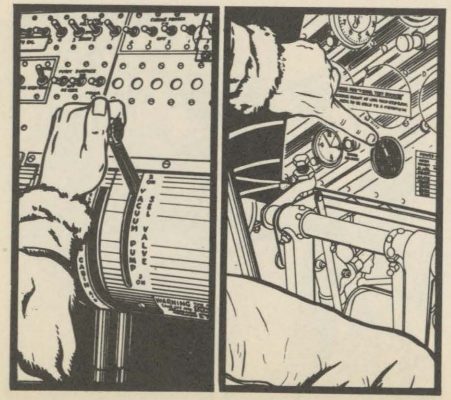




Set the ELEVATOR TRIM TAB control in NEUTRAL.

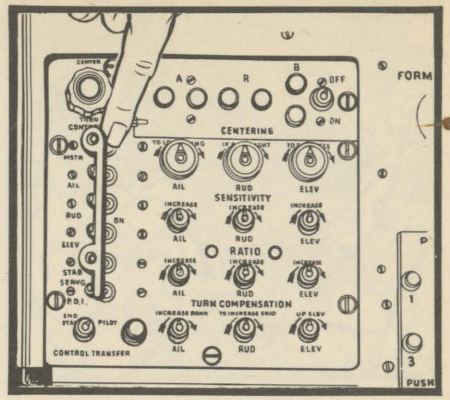


Check with the flight engineer for NORMAL and EMERGENCY hydraulic systems pressure gage readings of 800 to 1000 pounds per square inch.

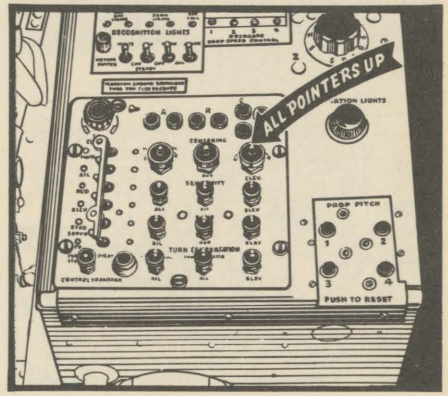


Order the flight engineer to turn the VACUUM PUMP SELECTOR handle to the number 2 engine. The instrument on the pilot's panel should read between 3.8 and 4.2 inches of mercury.

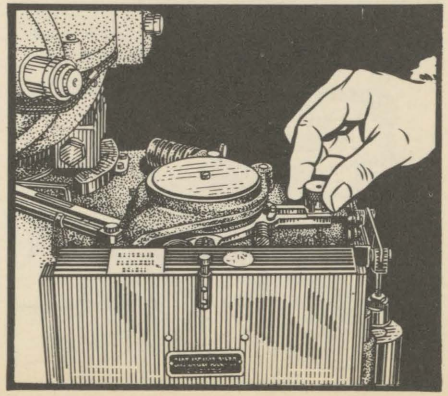
Check to see that the A.F.C.E.S. is OFF.

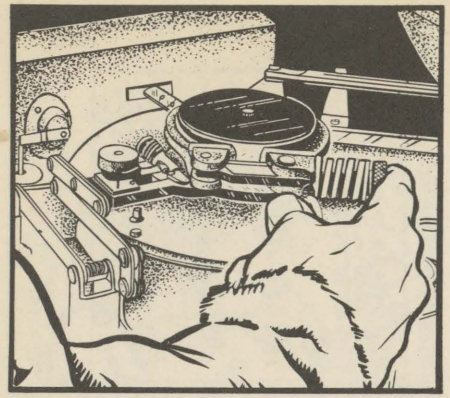


All knobs on the A.F.C.E.S. panel should be turned to "POINTERS UP". The TURN CONTROL should be CENTERED.

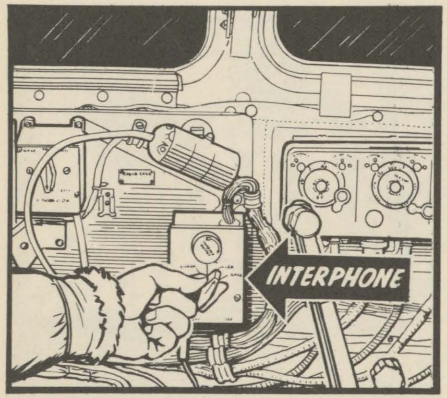


Have the bombardier engage the SECONDARY CLUTCH (on the bomb sight stabilizer) by turning the knob clockwise.

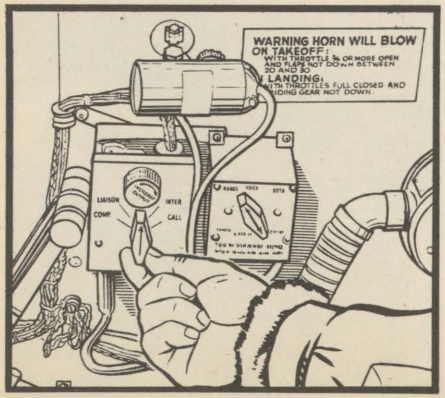




Have the bombardier disengage the DIRECTIONAL CLUTCH (on the bomb sight stabilizer) by pulling the lever.

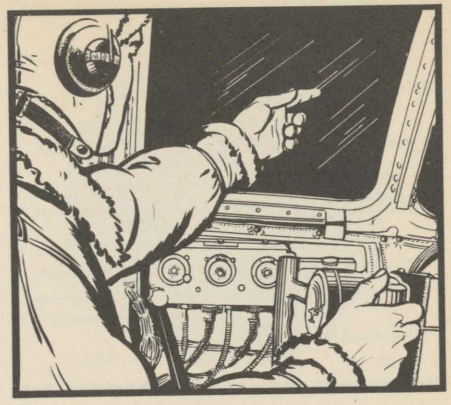


Be sure that all crew members are ready for take-off. Order the crew to "STAND BY TO TAXI."



The co-pilot will turn the JACK BOX SELECTOR switch to COMMAND and call the field tower for taxiing instructions. At the same time . . . .

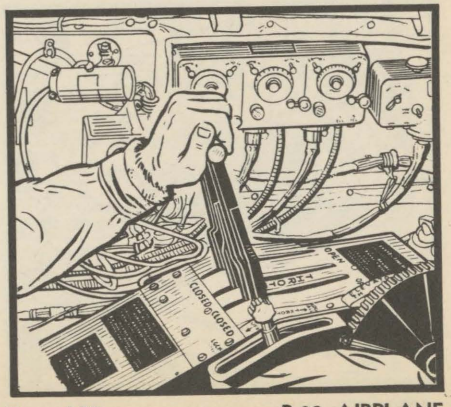
. . . . the pilot will signal the ground crew to remove the wheel chocks and to stand clear of the propellers.

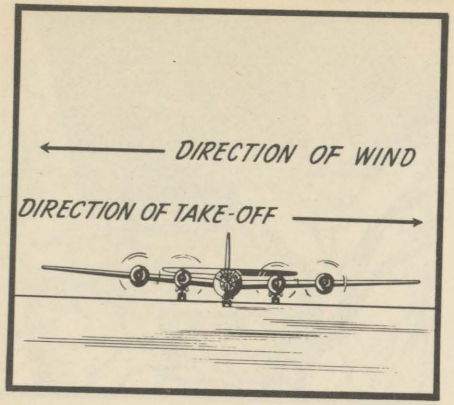


Release the PARKING BRAKES.

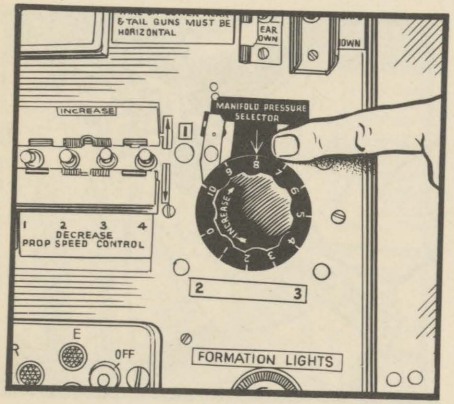


Acknowledge the field tower instructions to taxi. Release the BRAKES and advance the THROTTLES. NOTE: Use the outboard engines for steerage way.

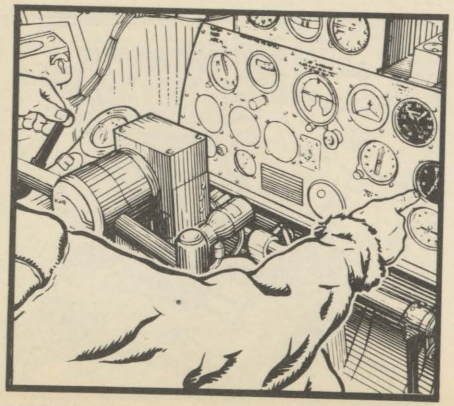




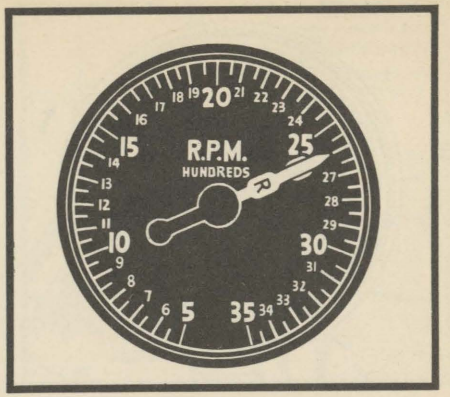
Turn the airplane to the run-up position and order the flight engineer to prepare for ignition check.



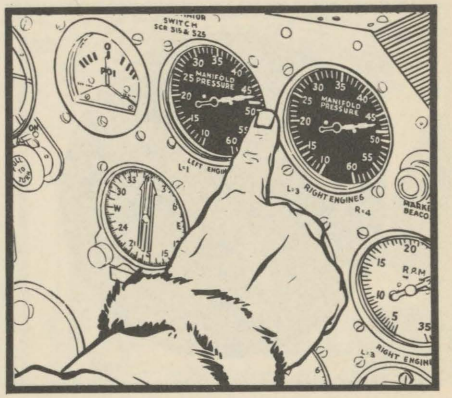
Turn the TURBOSUPERCHARGER knob to take-off position (Position 8).



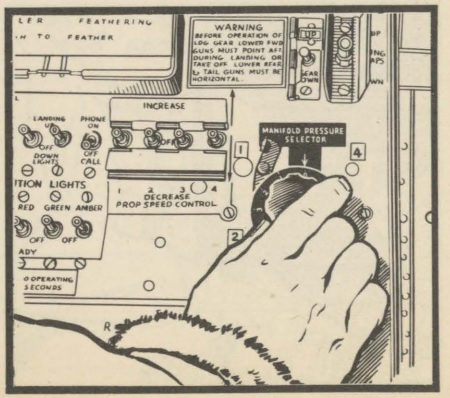
Advance the THROTTLE to 2000 rpm. Hold it at this speed until the flight engineer finishes the magneto check.



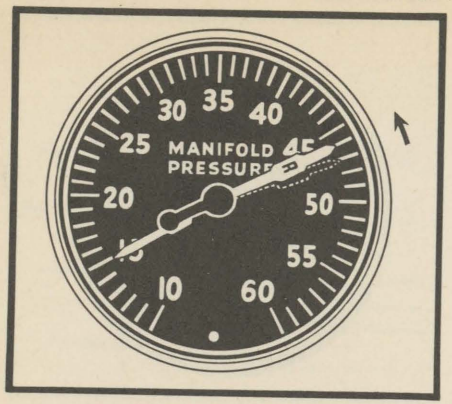
Advance the THROTTLE to its maximum rpm position (TACHOMETER should read 2600 rpm). At the same time . . . .



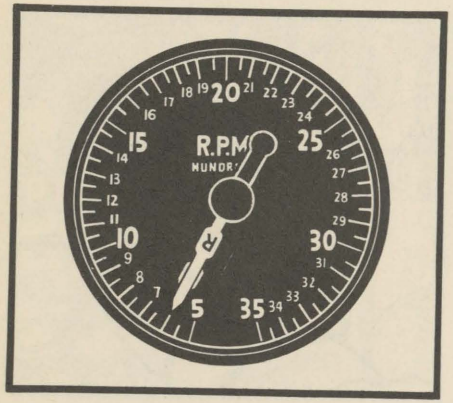
. . . . the MANIFOLD PRESSURE gage should read 47 inches of mercury. NOTE: In flight, manifold pressure will read 47.5 inches of mercury.



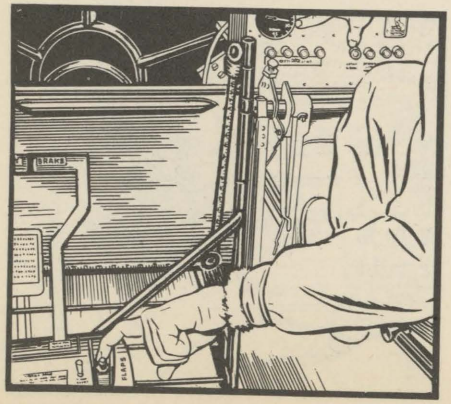
Turn the TURBOSUPERCHARGER knob to zero and . . . .



. . . . observe the drop in MANIFOLD PRESSURE. (This indicates that the turbosupercharger is functioning.)

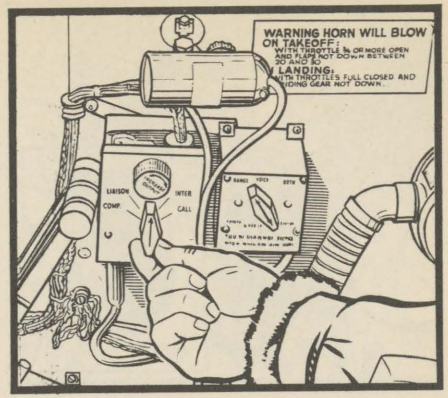


Reduce the THROTTLE setting to IDLE (550 to 600 rpm). NOTE: Move the throttles slowly and evenly to insure smooth power application. Sudden acceleration or deceleration may cause damage to the engine. Repeat this procedure for each engine.

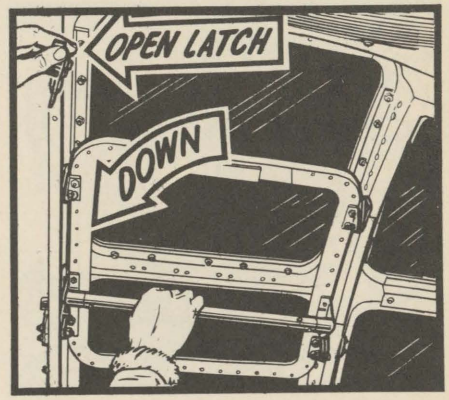


The co-pilot will set the WING FLAPS to 25 degrees down for the take-off. Obtain a report from the side gunners that the wing flaps are in take-off position.

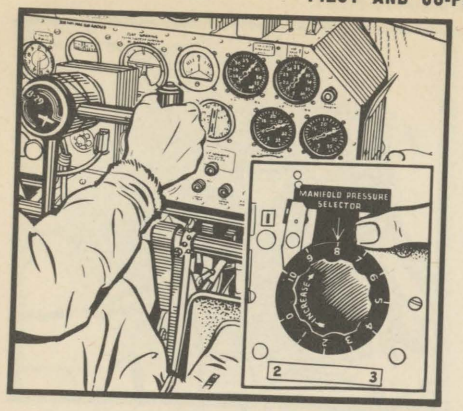
Call the field tower for take-off instructions. Taxi to the runway.



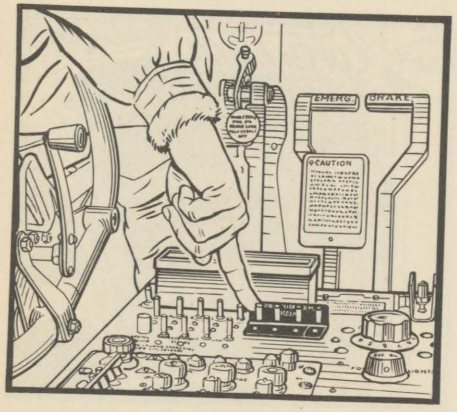
Be sure that all crew members are ready for the take-off. All windows and hatches should be closed. Order the crew to "STAND BY FOR TAKE-OFF."



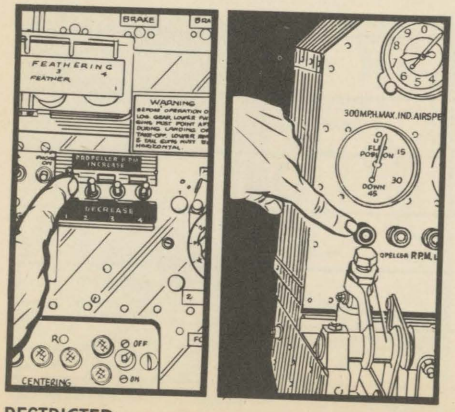
NOTES:



Set the TURBOSUPERCHARGER knob to POSITION 8. Advance the THROTTLES to 40 inches of mercury. Hold the brakes ON. At the same time . . . .

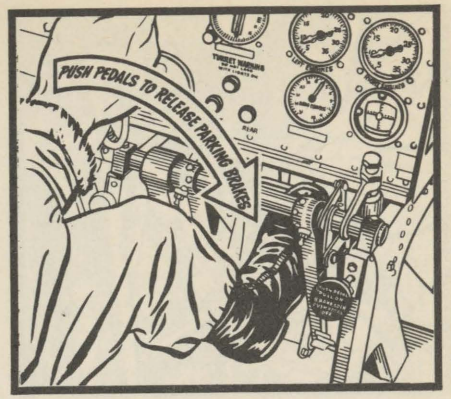


. . . . decrease the propeller rpm about 200 and note the increase in manifold pressure.

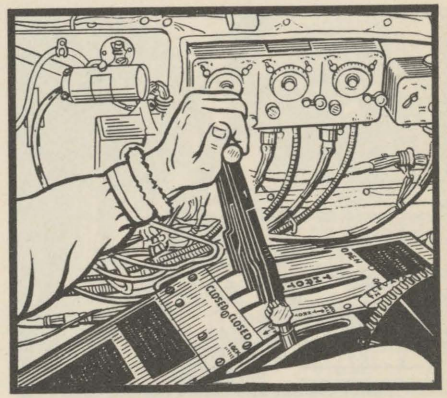


Set the PROPELLER SPEED CONTROL switch to INCREASE rpm, permitting the propellers to attain the maximum rpm position. NOTE: This will indicate that the propeller governors are operating properly and that no air is in the governor lines.

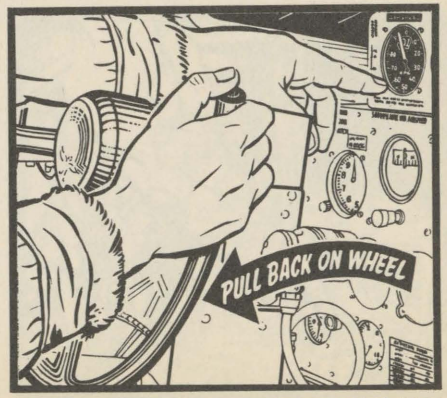
Release the BRAKES. As the speed of the airplane increases . . . .

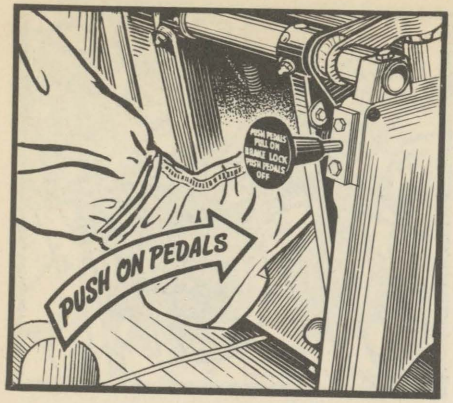


. . . . slowly advance all THROTTLES to the full power position. (Watch the manifold pressure and rpm.)

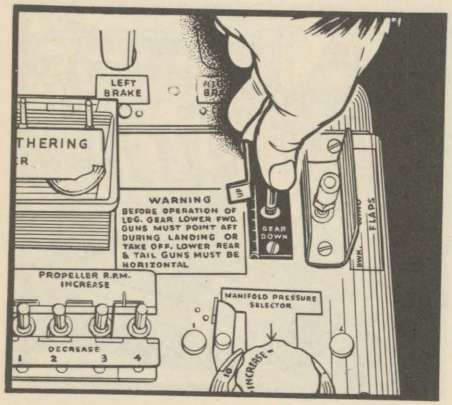


When the speed of the airplane reaches 95 mph IAS, slowly move the CONTROL COLUMN back. NOTE: Under 100,000 pounds gross weight, the airplane will take-off at about 100 mph IAS. Higher speeds are required for higher gross weights.

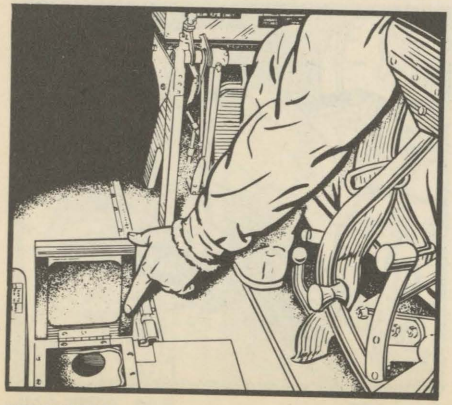




When the airplane is airborne, the pilot will apply the brakes to stop the wheels from turning and then issue his order to retract the landing gear.

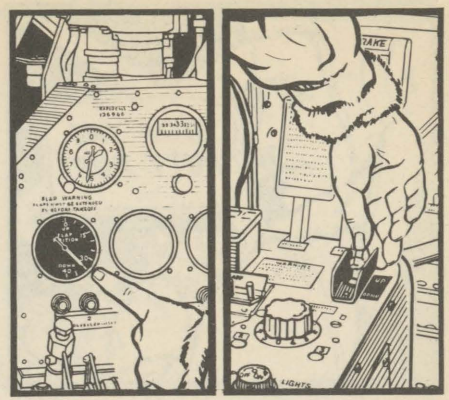


The co-pilot will hold the LANDING GEAR RETRACTING switch at the UP position. (The switch is spring-loaded and will automatically return to normal.)

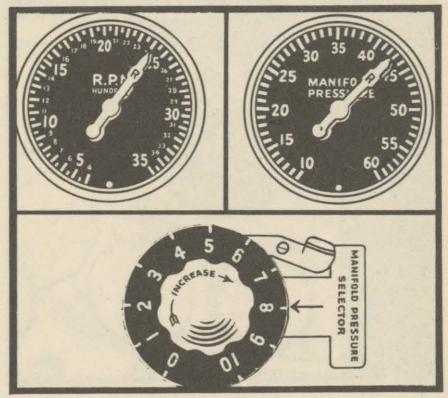


The co-pilot will inform the pilot when the landing gear is retracted. (The red light on the panel will be OFF.) Lift the inspection door in the floor of the cockpit and see that the gear is up.

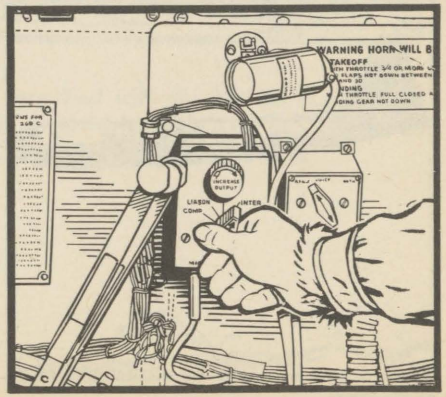
At a speed of 160 mph IAS and at a minimum altitude of 500 feet, the pilot will order the wing flaps retracted. Turn the WING FLAP switch ON and OFF at one-second intervals until the flaps are fully retracted. Check the WING FLAP POSITION INDICATOR and have both side gunners report when both flaps are up.



The pilot will order POWER CONDITION 2 set up as soon as possible (2400 rpm and 43 inches of mercury).

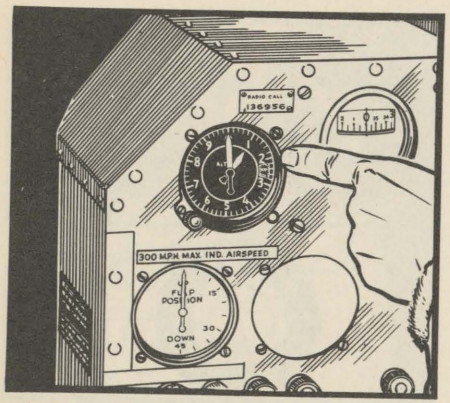


During flight, the co-pilot will remain on the interphone and relay reports to the pilot from crew members. He will occasionally make routine checks of all combat crew stations.

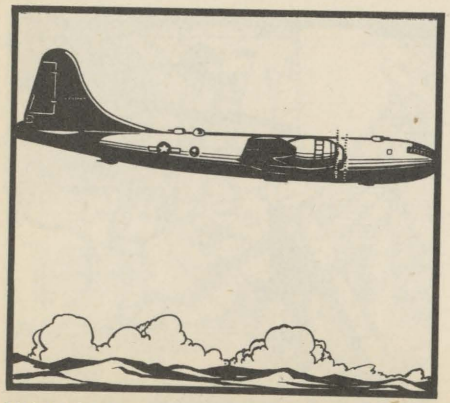




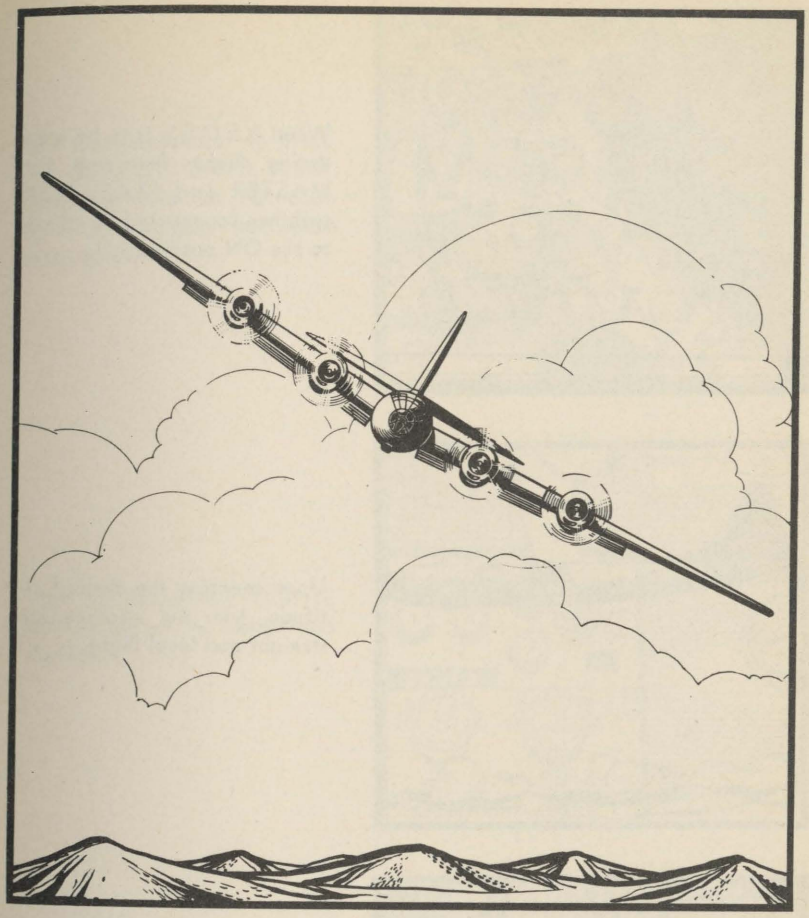
The pilot will instruct the flight engineer to have the AUXILIARY POWER PLANT stopped when additional power is no longer required.



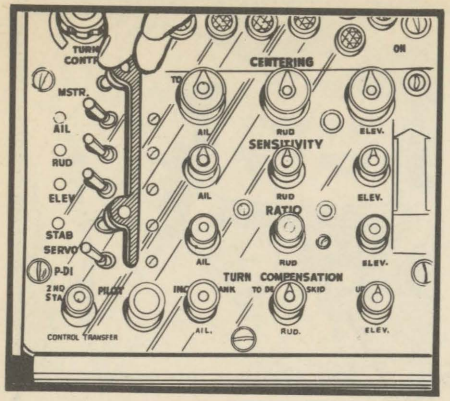
On long flights, periodically notify crew members of changes in altitude over 10,000 feet. The pilot will order the crew to use their oxygen masks.



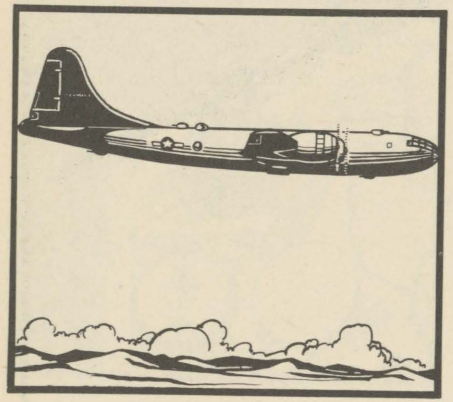
When the desired altitude is reached, level off the airplane. Notify the engineer that the airplane is to be prepared to CRUISE. Set the TURBO-SUPERCHARGER REGULATOR to 31 inches of mercury manifold pressure. Lock the THROTTLES in the FULL position and set the PITCH CONTROLS to 2100 rpm at 190 mph IAS.



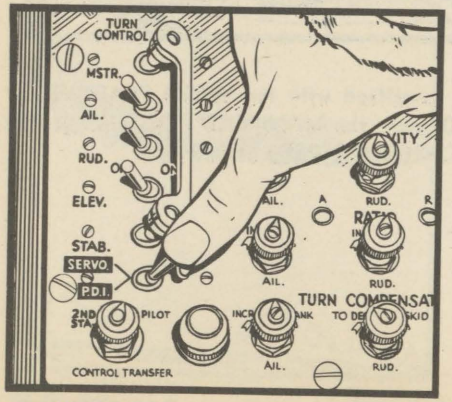
Turns up to a 30 degree bank are permitted with the WING FLAPS FULL DOWN, the engines at 2000 to 2100 rpm, the MANIFOLD PRESSURE at 25 inches of mercury, and at an INDICATED AIRSPEED of 140 mph.



When A.F.C.E.S. is to be used during flight, first turn the MASTER and STABILIZER switches (connected by a bar) to the ON position.

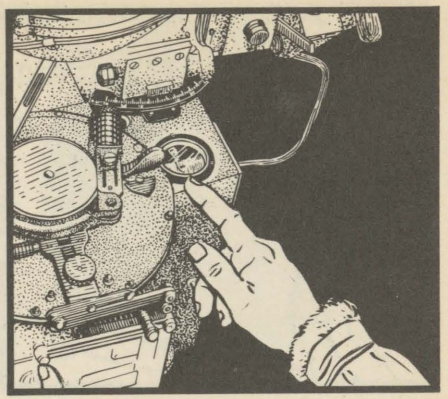


Upon reaching the desired altitude, trim the airplane for straight and level flight.

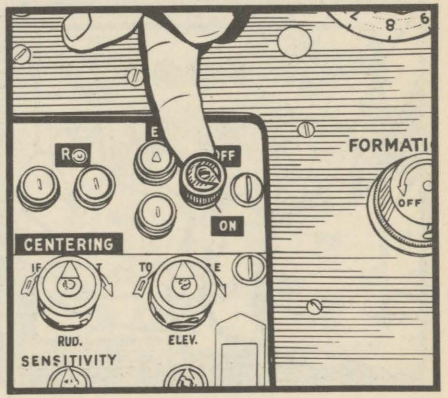


Turn the PDI switch ON. Allow a minimum of 10 minutes to elapse between turning the MASTER switches and the PDI switch ON.

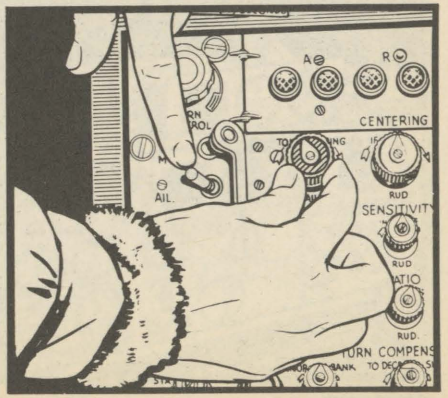
Tell the bombardier to press the DIRECTIONAL ARM LOCK to hold the PDI centered and engage the automatic pilot.

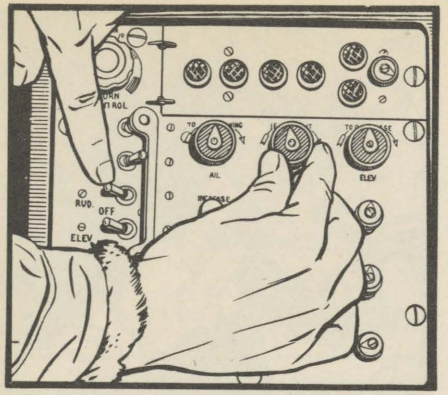


Turn the TELL-TALE LIGHTS ON by use of the switch and shutters.

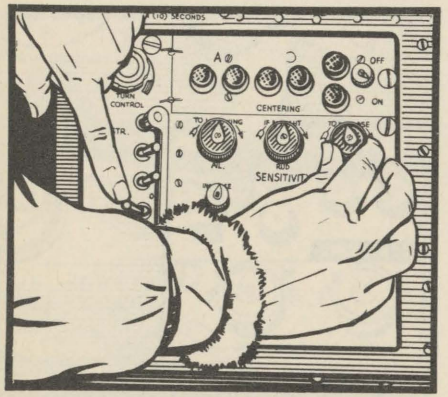


Maintain straight and level flight for three minutes. Turn the AILERON TELL-TALE LIGHTS OFF with the AILERON CENTERING knob. Throw the AILERON switch to the ON position.

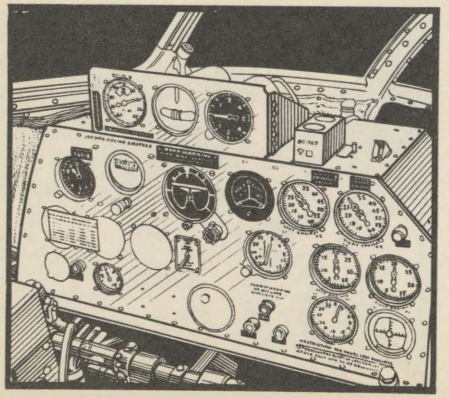




Turn the RUDDER TELL-TALE LIGHTS OFF with the RUDDER CENTERING knob. Throw the RUDDER switch to the ON position.

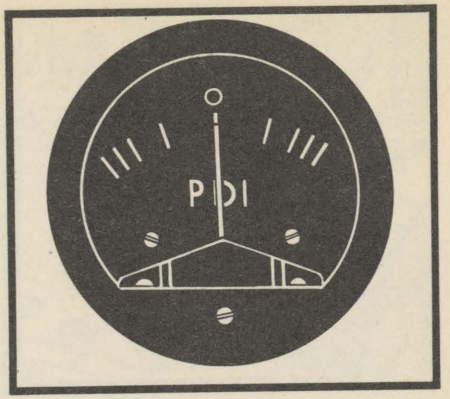


Turn the ELEVATOR TELL-TALE LIGHTS OFF with the ELEVATOR CENTERING knob. Throw the ELEVATOR switch to the ON position.

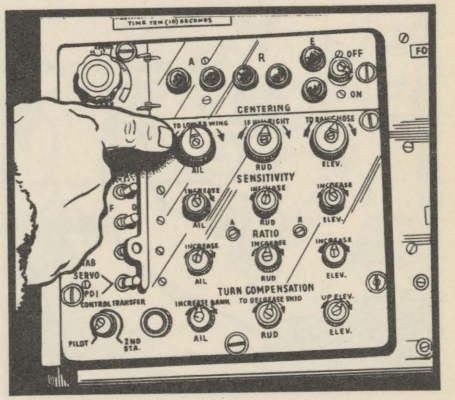


Have the bombardier release the PDI lock. Observe the indications of the PDI, the artificial horizon, the rate of climb, and the altimeter.

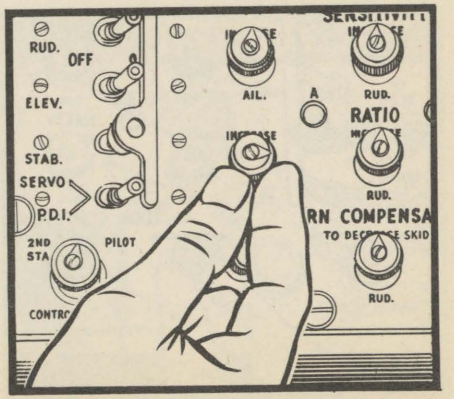
Center the PDI for straight and level flight, using the knobs for final adjustment.

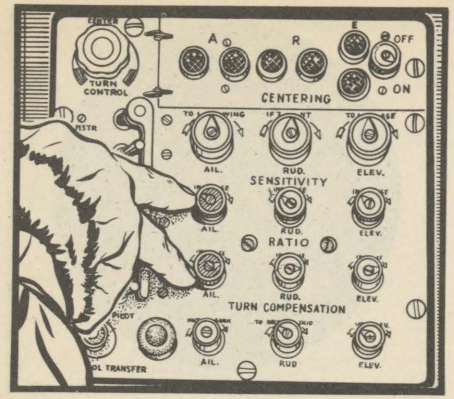


If changes in load distribution require subsequent adjustments, make adjustments with the CENTERING knobs. (The CENTERING knobs are trim tabs for the automatic pilot.)

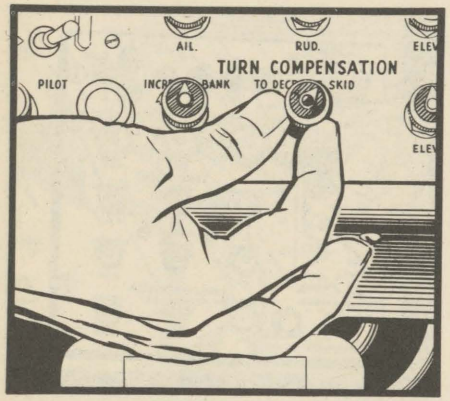


The SENSITIVITY control knobs select the SPEED at which the controls will be moved, and the RATIO knobs regulate the AMOUNT of control which will be applied for a given deviation. These knobs must be adjusted in the following order: (1) AILERON; (2) RUDDER; (3) ELEVATOR.

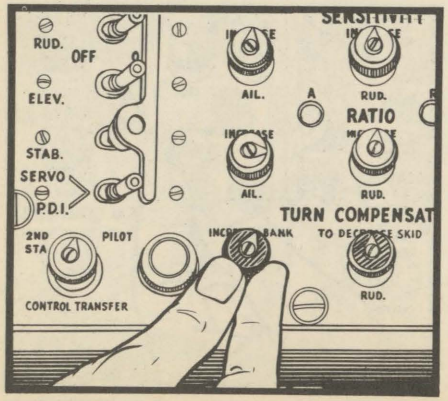




As the RATIO is INCREASED, SENSITIVITY should be DECREASED. Otherwise, overcorrection of ratio will result.

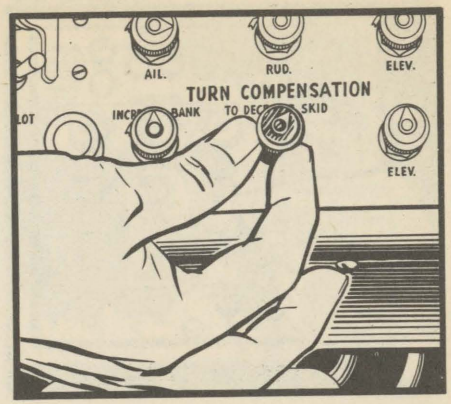


TURN COMPENSATION knobs should only be adjusted during turns made from the bomb sight stabilizer.

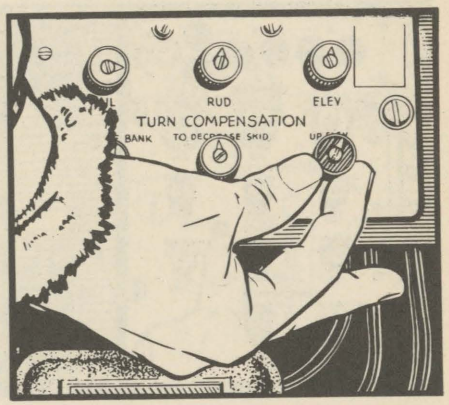


To accomplish a turn while flying on the automatic pilot, first adjust the AILERON COMPENSATION knob until the airplane is in an 18 degree bank. Check the angle of bank as indicated on the gyro horizon instrument.

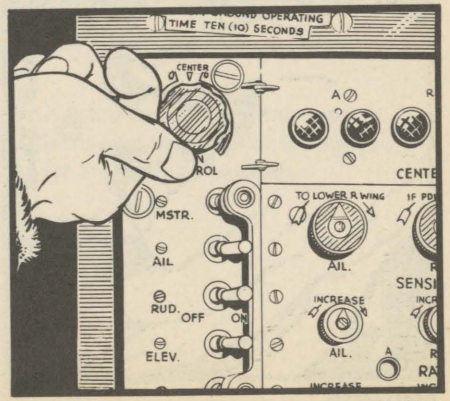
Adjust the RUDDER COMPENSATION knob to prevent skidding or slipping. Check on the ball-bank instrument. Maintain a perfect bank by adjusting both the aileron and the rudder.

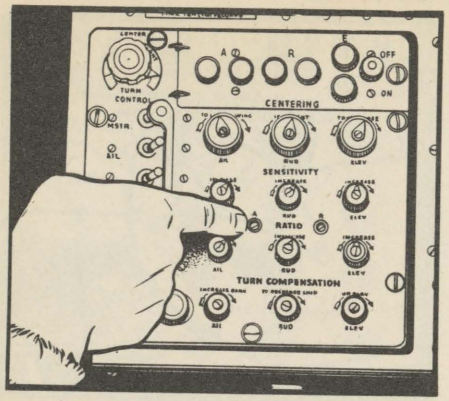


Adjust the ELEVATOR knob to maintain altitude.

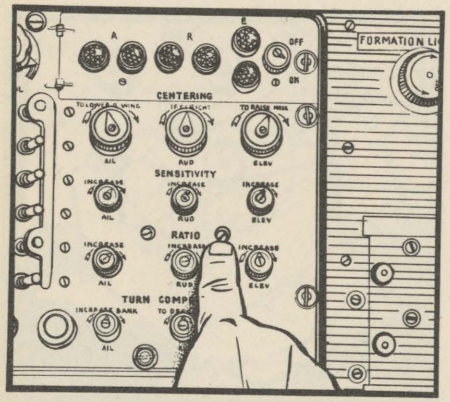


Set the TURN CONTROL to "30 degrees bank", that is, to the first turn control notch (at the beginning of the triple line area on the dial).

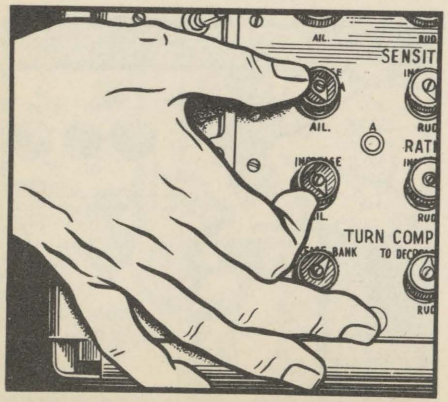




Remove the cap and adjust the AILERON TRIMMER screw until the airplane assumes a 30 degree angle of bank.

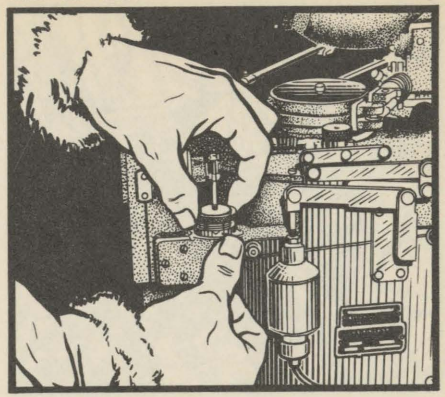


Remove the cap and adjust the RUDDER TRIMMER screw until the turn is coordinated. Replace both caps.

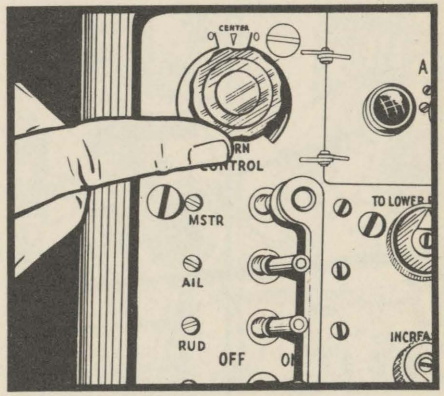


If the airplane tends to "wallow" or "RUDDER HUNT", correct the condition by setting the RATIO, SENSITIVITY, and COMPENSATION knobs in the optimum position.

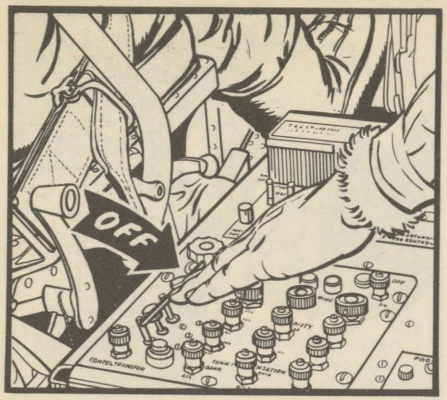
This flight condition may be caused by incorrect setting of the DASHPOT on the bomb sight STABILIZER. Unlock the control by moving the lever to the right and then have the bombardier adjust the knurled knob up or down until the hunting ceases. Lock this adjustment.



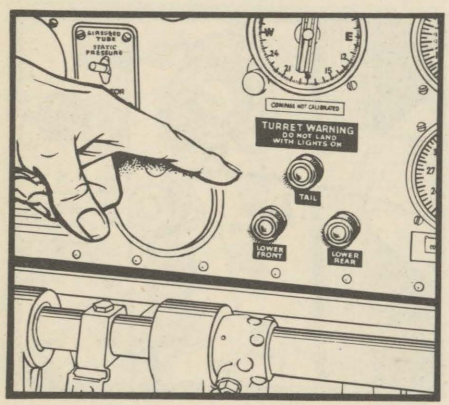
To bring the airplane back to straight and level flight, set the TURN CONTROL knob to zero.



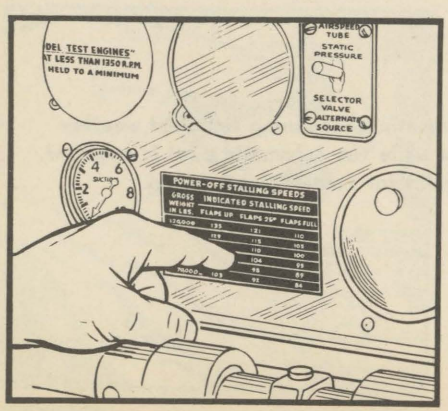
CAUTIONS: Do not use the automatic pilot during turbulent weather.
Do not adjust the trim tabs while the automatic pilot is engaged.
Do not use the automatic pilot for take-offs or landings.



Call the field tower for landing instructions. Instruct the crew to prepare for landing at least ten minutes in advance of the expected landing time. Turn the A.F.C.E.S. OFF.

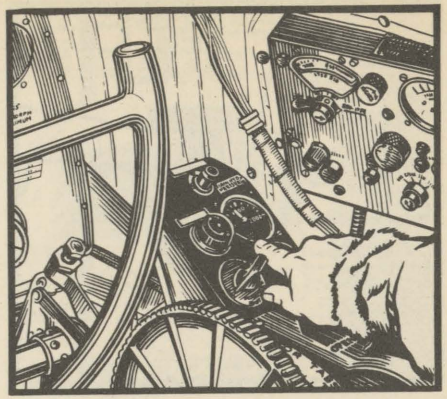


See that all the turrets are locked in the landing position. Warning lights must be OFF.

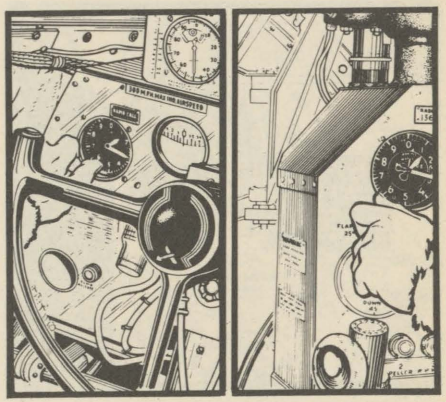


See that the flight engineer is ready for the landing. Examine the flight log Consult the CENTER OF GRAVITY chart and weight computations to determine the approximate stalling speed.

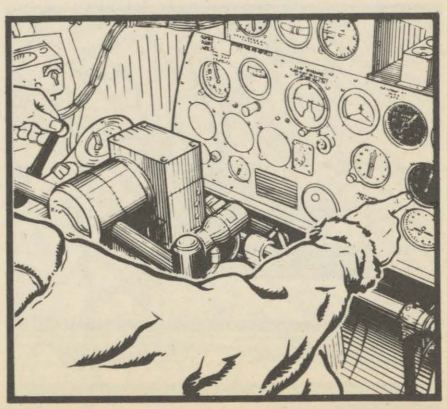
Apply the brakes to check both HYDRAULIC SYSTEMS for a pressure of 800 to 1000 pounds per square inch.

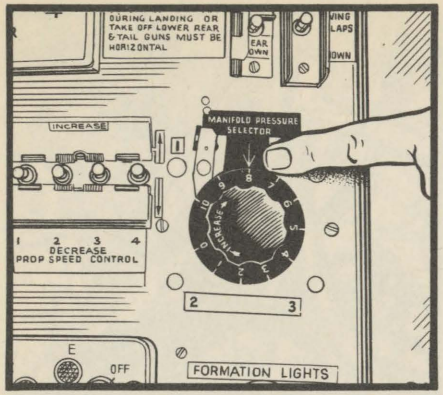


Set the ALTIMETER to correspond with the barometric pressure at the field.

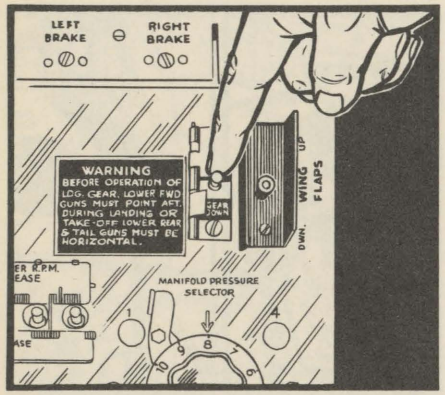


Set the PROPELLERS to 2100 rpm.

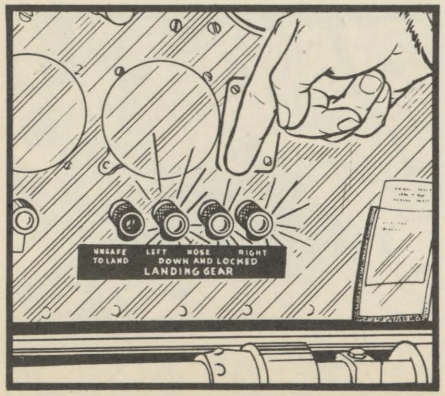




Set the TURBOSUPERCHARGER CONTROL knob to POSITION 8. The co-pilot will check with the crew members.

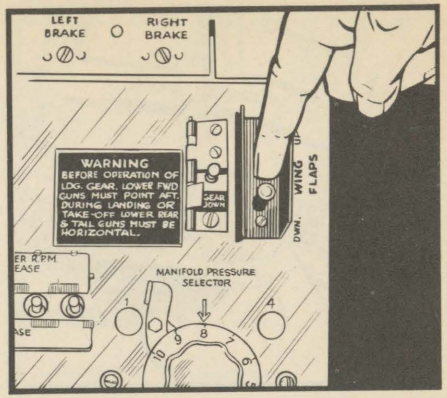


The pilot will order the landing gear lowered when advised by the co-pilot that the crew is ready for landing and that the airplane has slowed down to 180 mph or less. Set the LANDING GEAR switch in the DOWN position.

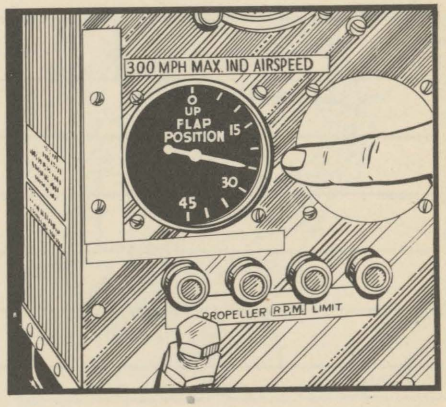


See that the landing gear position warning lights indicate that the gear is down. Have the side gunners visually check and report that the main gear is down. Visually check the nose gear through the window in the floor of the cockpit.

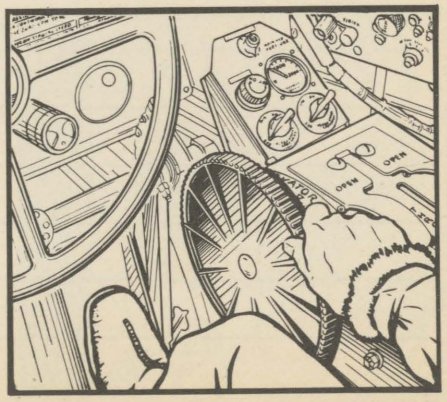
If the airplane has been in combat, the co-pilot will lower the wing flaps 5 degrees. Have the side gunners check the flaps for damage. CAUTION: Do not lower the flaps if the IAS is more than 200 mph.



For the initial approach, the pilot will order the WING FLAPS extended 25 degrees. Have the side gunners check and report that the flaps are down 25 degrees.

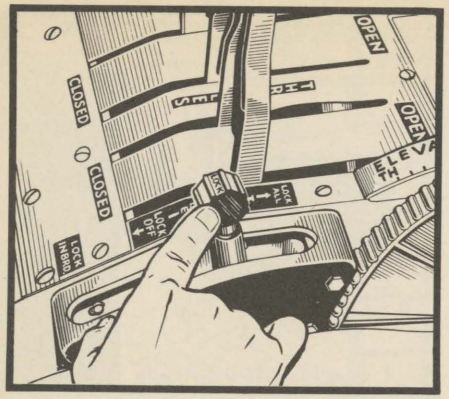


Set the TRIM TABS as required by the attitude of the airplane.



BEFORE LANDING

PILOT AND CO-PILOT



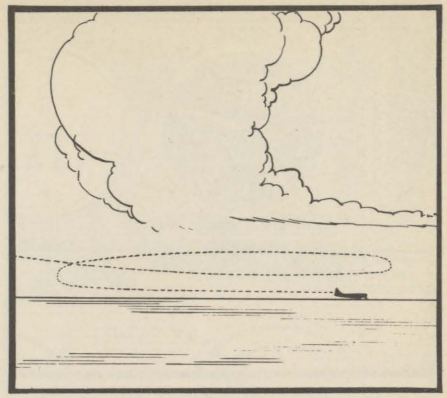
Set the THROTTLE BRAKE to obtain the desired friction.

NOTES:

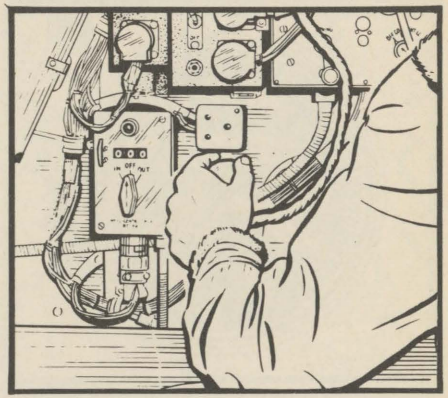
DURING LANDING

PILOT AND CO-PILOT

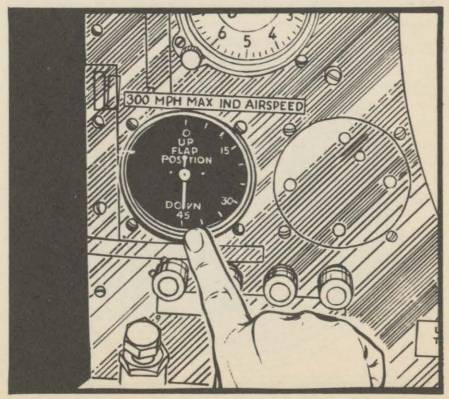
Accomplish a standard approach for landing at about 30 mph IAS above the stalling speed.

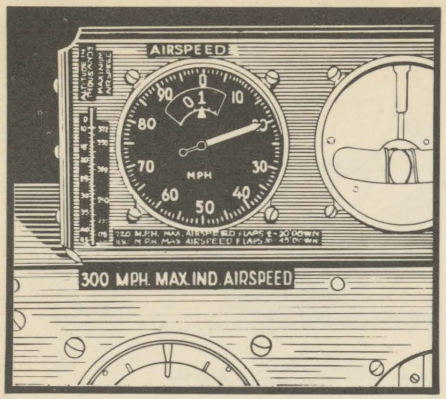


Be certain that the DETONATOR plug is disconnected.

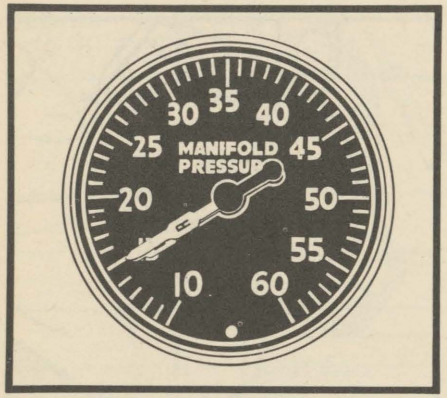


On the final approach, order the WING FLAPS lowered to the full down position. The co-pilot will call out the airspeeds as the airplane approaches the runway.

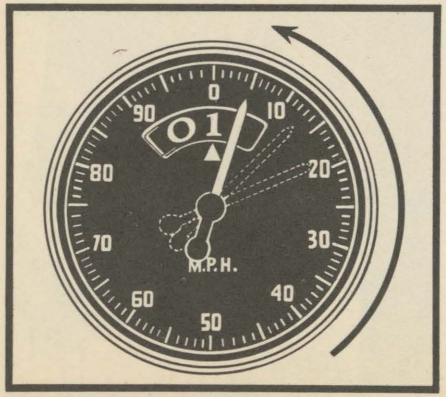




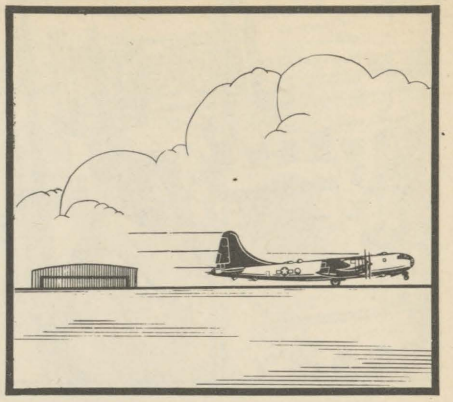
The initial landing approach will be made at about 120 mph IAS.



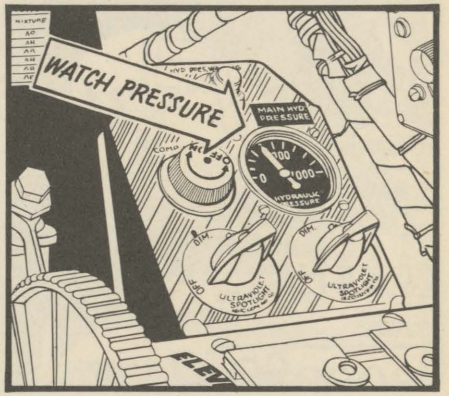
Maintain a MANIFOLD PRESSURE of about 15 inches of mercury.



The co-pilot will continue to call out the airspeeds as they decrease.

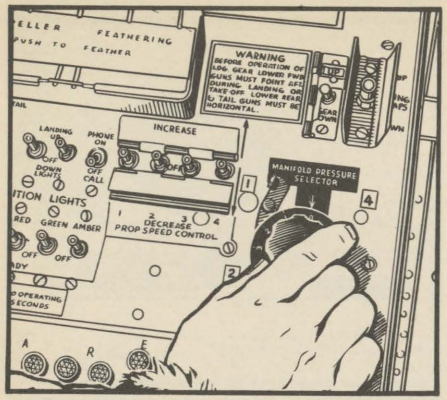


Upon contact with the ground, the airplane should be slightly tail low. Be careful to judge the approach to allow ample runway in which to stop the airplane.

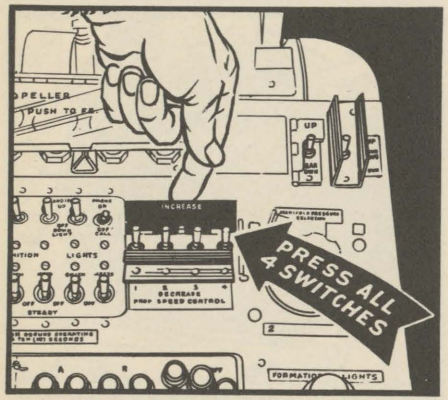


The landing speed will be between 95 and 100 mph IAS. The co-pilot will call out the hydraulic pressures as soon as the airplane is on the ground to assure the pilot that pressure is available for braking. Brake the airplane to retard its speed.

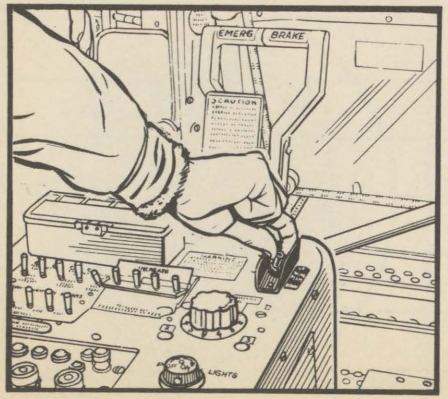
NOTES:



Set the TURBOSUPERCHARGER CONTROL knob to zero and . . . .

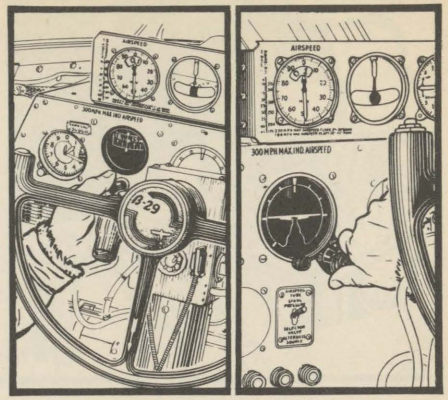


. . . . the propellers at INCREASE rpm.

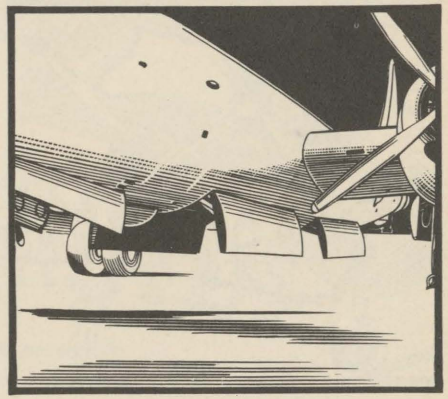


Raise the WING FLAPS after the airplane has stopped rolling and power is applied for taxiing. NOTE: At least two generators must be in operation to supply power for this operation.

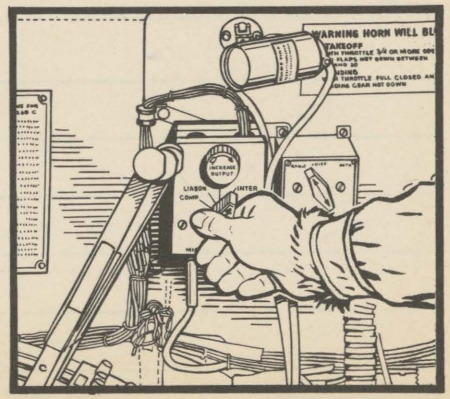
Cage all gyro instruments.



Order the bomb bay doors opened.

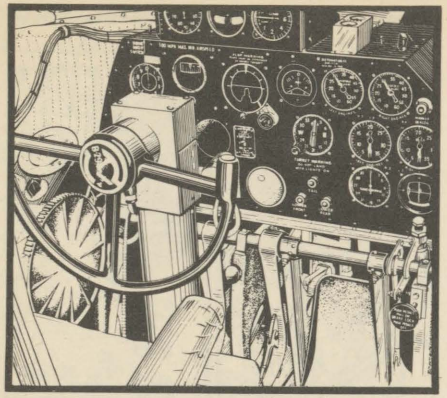


Instruct the co-pilot to inform the crew over the interphone that they may leave the airplane and join the formation for the pilot's inspection.

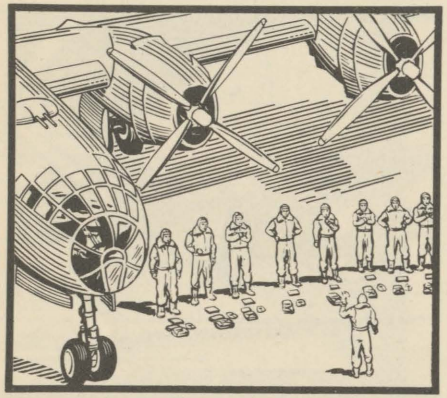


AFTER LANDING

PILOT AND CO-PILOT



Turn all switches OFF. Order the AUXILIARY POWER PLANT stopped. WARNING: Do not set the parking brakes immediately after landing. Allow them to cool. It is recommended that the parking brakes be set ON if the airplane is grounded over night during cold weather.



The pilot will inspect the crew for physical condition. Reports of functioning of all equipment at each crew member's station will be received.

NOTES:

FLIGHT ENGINEER'S CHECK LIST

BEFORE ENTERING THE AIRPLANE

- Weight and C.G. location.
- Crew chief's tool kit.
- Propellers.
- Turbosuperchargers.
- Fire extinguishers.
- Personal effects.

BEFORE STARTING THE ENGINES

- Weight and C.G. location.
- Flight log.
- Ignition and battery switches.
- Propellers pulled through.
- Emergency flap motor.
- Crew chief's tool kit.
- Voltage regulator vent valves.
- Parachute
- Oxygen.
- Clothing.
- Life preserver.
- Cabin pressure release valve.
- Battery switch.
- Emergency switch (pilot's).
- Master switch.
- Auxiliary power plant.
- Lights.
- Controls—freedom of movement.
- Normal and emergency hydraulic pressure.
- Brakes and wheel chocks.
- Fuel quantity.
- Oil quantity.
- Aux. P.P. voltage.
- Inverter.
- Cowl flaps.
- Oil cooler shutters.
- Intercooler shutters.
- Turbosuperchargers.
- Fuel valves.

Mixture controls.
Fuel booster.
Fire extinguishers.
Cabin pressure warning switch.
Clock.

DURING ENGINE STARTING AND WARM-UP

Oil pressure (nose).
Oil pressure (rear).
Fuel pressure.
Cylinder head temperature.
Wing de-icers.
Generator switches.
Vacuum.

BEFORE TAKE-OFF

Cabin supercharger.
Generators.
Cowl flaps.
Fuel booster.
Cylinder head temperature.
Oil pressure (nose).
Oil pressure (rear).
Oil temperature.
Manifold pressure.

DURING FLIGHT

Intercooler shutters.
Fuel booster pump.
Auxiliary power plant.
Cowl flaps.
Mixture.
Oil pressure (nose).
Oil pressure (rear).
Fuel pressure.
Generators.
Cylinder head temperature.
Oil temperature.
Cabin supercharger system.

Manifold pressure.
Log.
Make out log sheet every 30 minutes.

BEFORE LANDING

Weight and C.G. location.
Auxiliary power plant.
Mixture.
Fuel booster pump.
Oil pressure (nose).
Oil pressure (rear).
Oil temperature.
Manifold pressures.
Generators.
Cylinder head temperature.
Fuel pressure.
Cabin supercharger system.
De-icers.
Hydraulic system.
Magneto drop.
Intercooler shutters.

LANDING

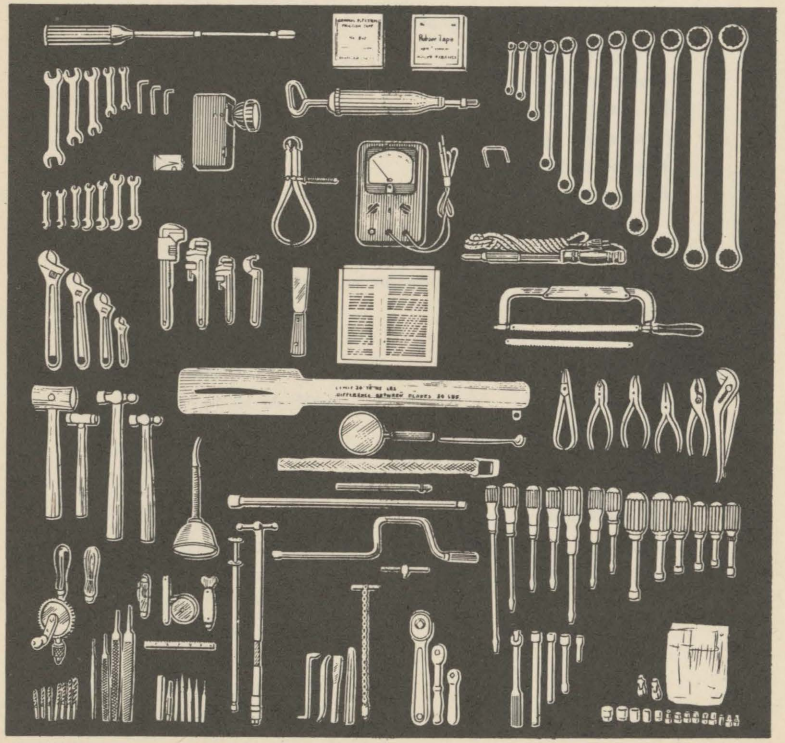
Checking run-away propeller when power is applied suddenly.

AFTER LANDING

Cowl flaps.
Fuel booster.
Parking brakes and chocks.
Oil dilution.
All switches.
Auxiliary power plant.
Control lock.

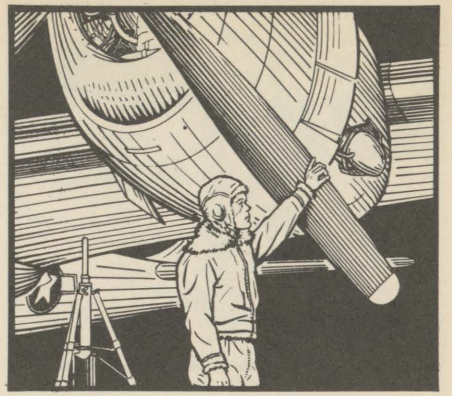


Compute the weight of the airplane and its contents. Determine the location of the center of gravity.

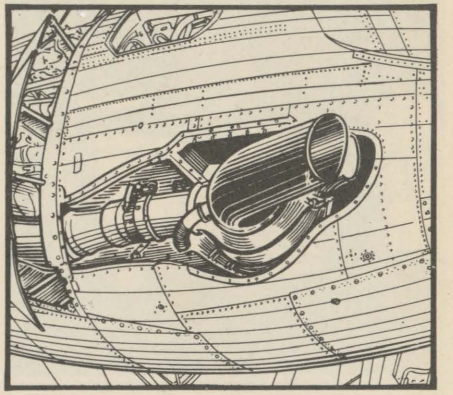


Check the crew chief's tool kit. See that none of the tools are missing.

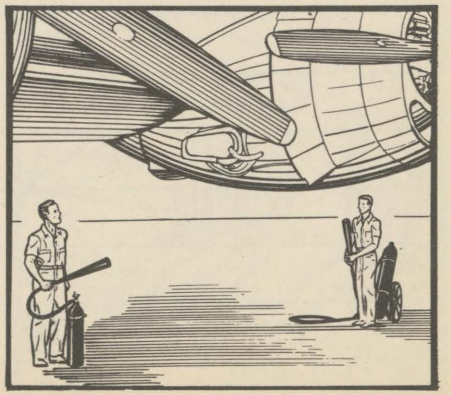
Inspect all the propeller blades. Look for cracks, nicks, burrs, dents, or other imperfections.

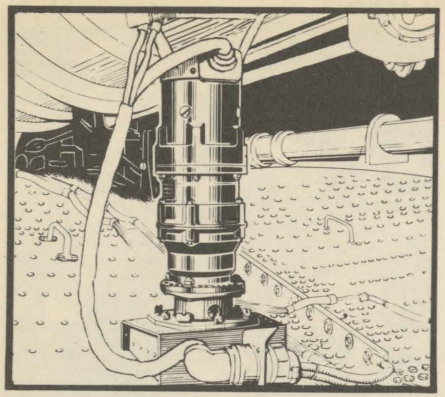


Visually check all turbosuperchargers.

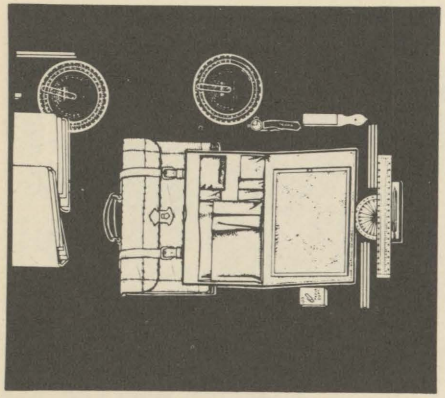


See that the ground crew has at least two fire extinguishers within easy reach for possible fires during starting.





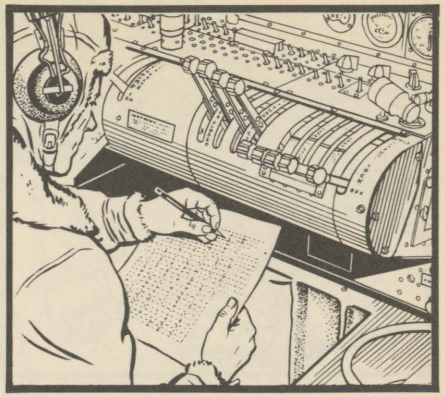
Visually check to make sure that the EMERGENCY PORTABLE RETRACTING MOTOR is installed properly.



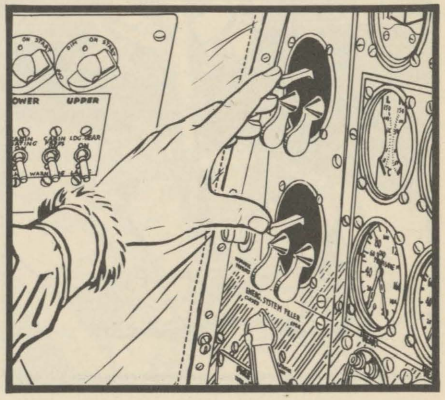
Prepare your personal effects for inspection by the pilot.

NOTES:

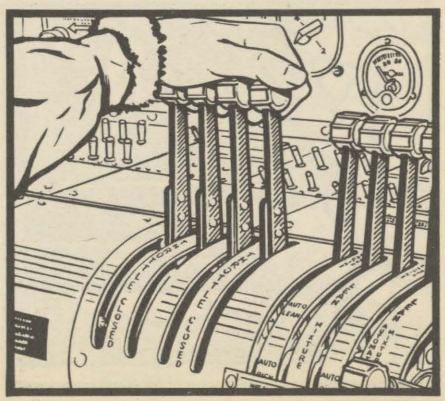
Complete as much of the flight log as possible while on the ground. Make sample calculations to determine what effect depletion of fuel and oil, dropping of the bombs or bomb bay tanks, etc., will have on the location of the center of gravity.

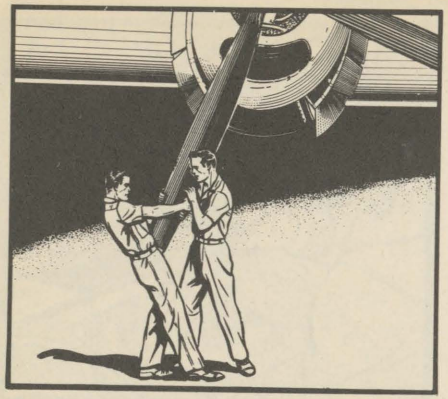


Check and see that the IGNITION switches are OFF. Inform the pilot that the propellers are ready to be pulled through.

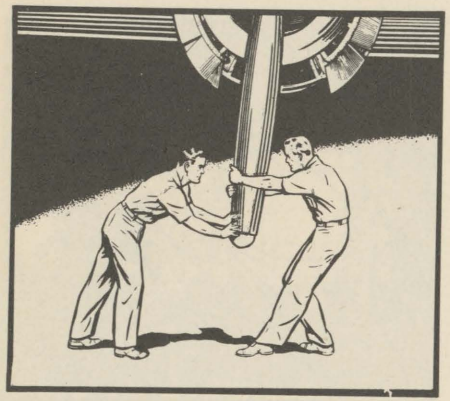


Move all the throttles to the full OPEN position when the propellers are being turned by hand. Each propeller will be pulled through twenty blades. CAUTION: Do not permit more than three men to pull on a blade.

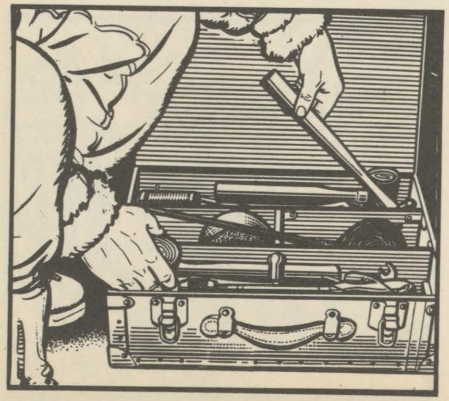




If a propeller does not rotate normally, or seems to be obstructed, reverse the rotation through three blades. If this does not remove the obstruction, remove the spark plugs from the lower cylinders, turn the propeller a few times, and permit any oil to drain. Install clean spark plugs and again pull the propeller through.

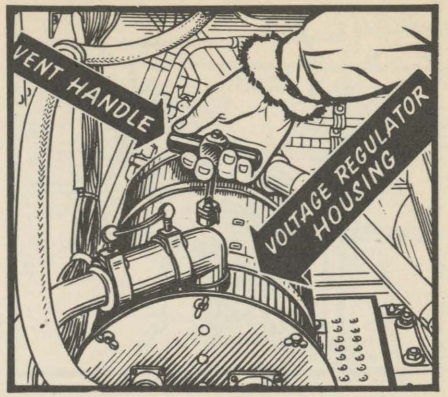


CAUTION: Do not turn a propeller if the cylinder head temperature is greater than 100 degrees Centigrade. If the engines are not started within 30 minutes of the previous run-up, or the time the propellers were pulled through, it will be necessary to turn the propellers again by hand.

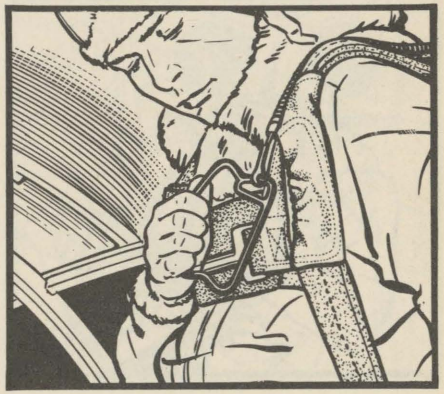


See that a complete crew chief's tool kit is in the airplane.

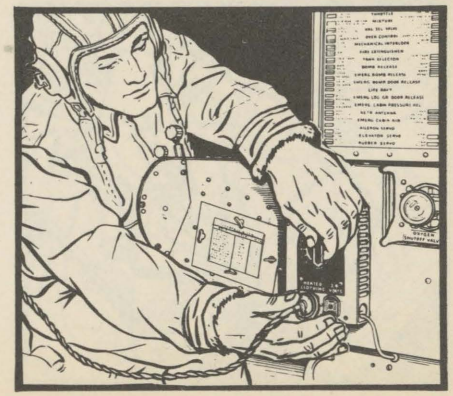
The vent valves on each VOLTAGE REGULATOR container must be OPEN (valve handle in the UP position).

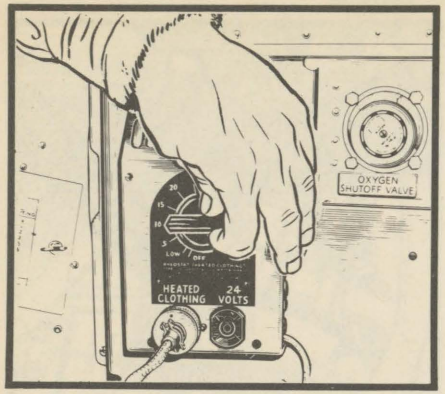


Visually check your PARACHUTE. See that the rip cord handle is not dangling or loose.



Plug in the connector of your HEATED FLYING SUIT. Be sure that the RHEOSTAT is in the OFF position.

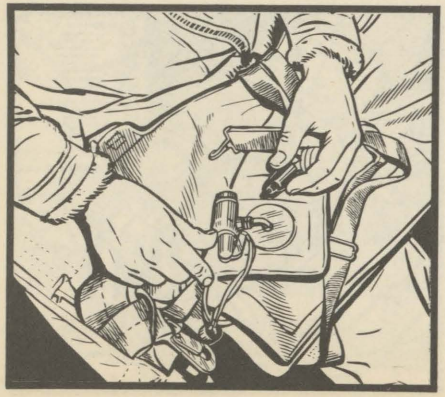




Try the various circuits. Be sure that each circuit operates properly and that the elements in your suit supply heat.

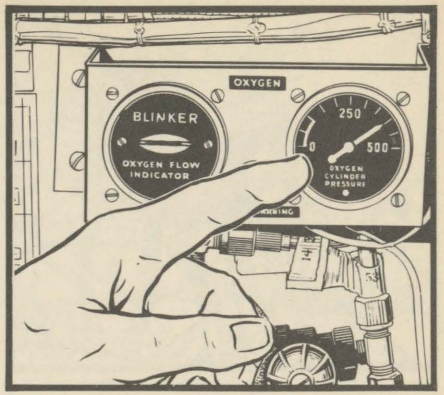


Be sure that the heated suit fits well. A good fit insures adequate warmth with minimum drain on the current supply.

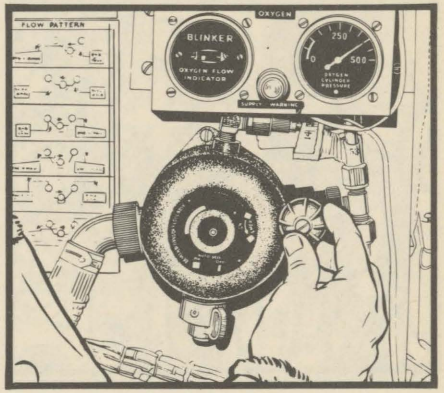


Check your LIFE PRESERVER ("Mae West"). See that it is not torn. Be sure that the CO_2 capsule is charged and that the puncturing arm is safetied. Examine your OXYGEN MASK. Stow it within easy reach. See that a fully charged portable oxygen bottle is within easy reach.

The OXYGEN SUPPLY PRESSURE GAGE should read 400 to 425 pounds per square inch.

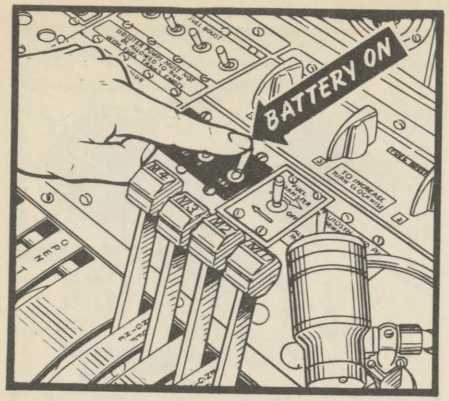


Check the operation of the OXYGEN FLOW INDICATOR. Turn the emergency valve to the ON position. The flow indicator will stay open.

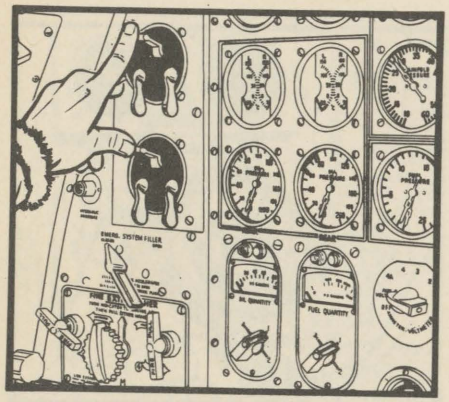


See that the CABIN PRESSURE RELIEF VALVE under the seat is CLOSED.

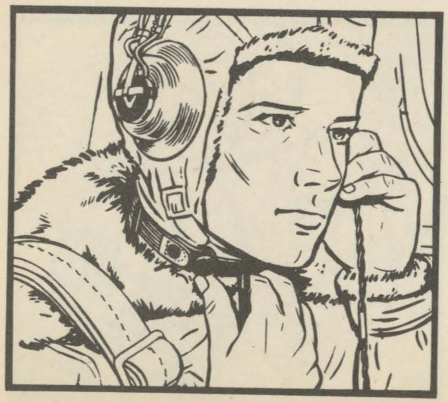




Turn the BATTERY switch to the ON position.

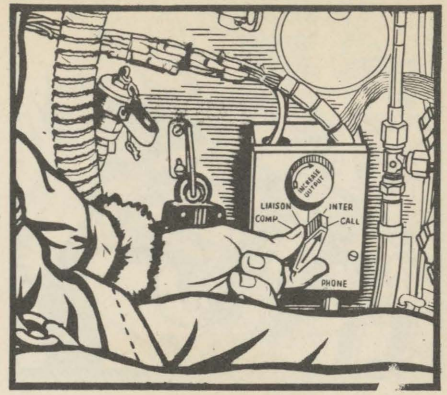


Turn both MASTER IGNITION switches to the ON position.



Adjust your EARPHONES and THROAT MICROPHONE.

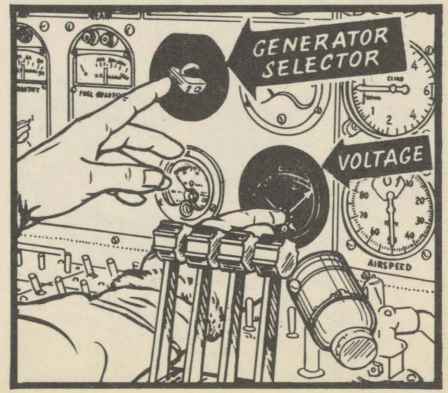
Turn the JACK BOX SELECTOR switch to INTER (interphone).

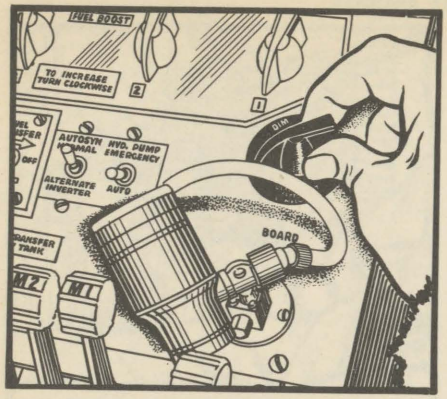


Respond to the co-pilot's check of the interphone system.

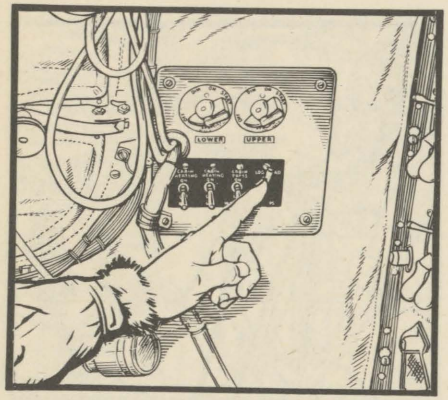


Order the AUXILIARY POWER PLANT started. (This unit must be started in accordance with the instructions given in the "Miscellaneous Data" section of this manual.)

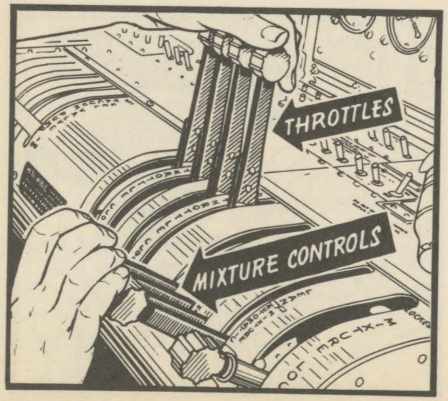




Check all the fluorescent lights and . . . .

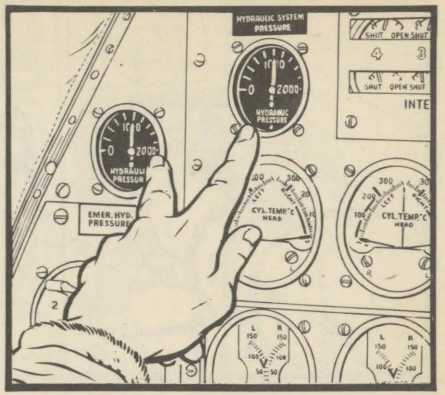


. . . . check the landing gear lights.

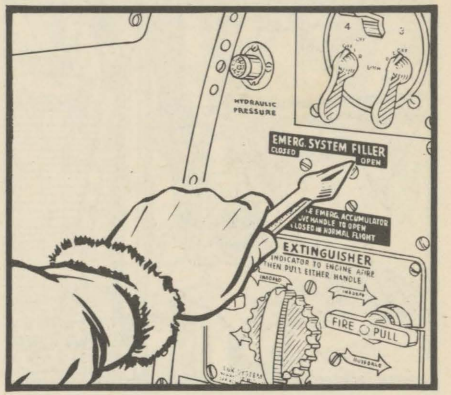


Move all controls through their full operating range to check their freedom of action.

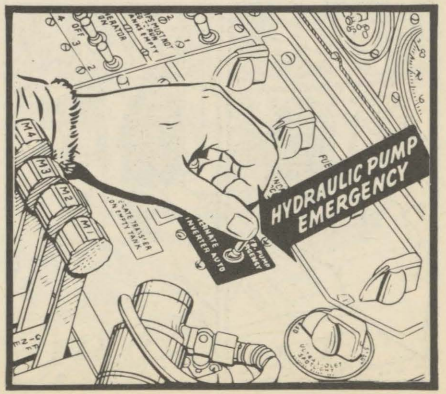
Both HYDRAULIC SYSTEM GAGES should read 800 to 1000 pounds per square inch.

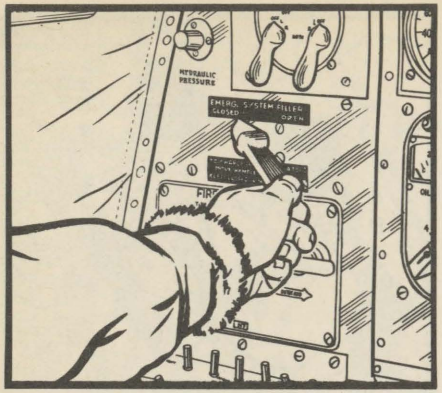


Turn the HYDRAULIC SHUT-OFF VALVE to the OPEN position and . . . .

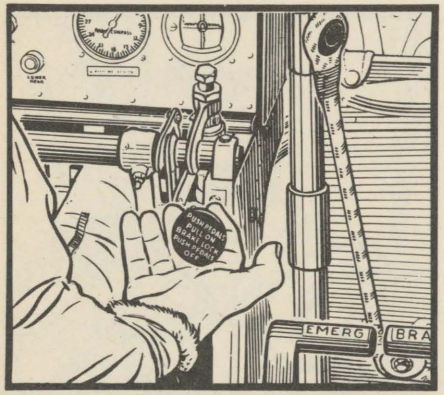


. . . . move the HYDRAULIC PUMP switch to the EMERGENCY position. Both hydraulic pressure gages should show an increase in pressure.

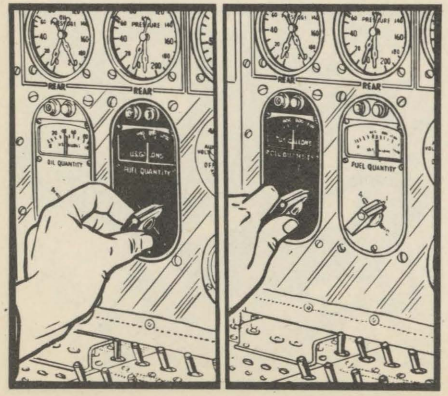




Return the pump switch to AUTO and the VALVE to CLOSE.

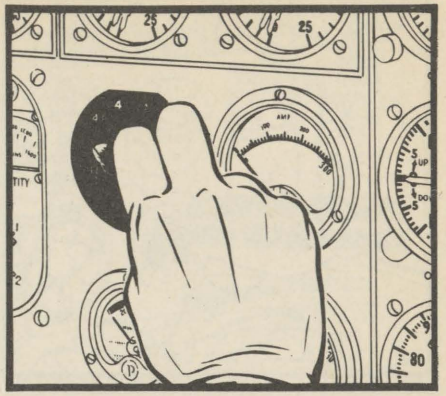


Check and see that the pilot's parking brake is ON and that the wheels are chocked fore and aft.

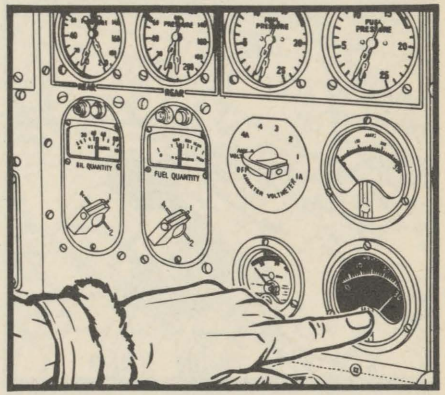


Determine the quantities in the FUEL and OIL tanks by turning the TANK SELECTOR handles successively to each of the tank positions while observing the gage indications.

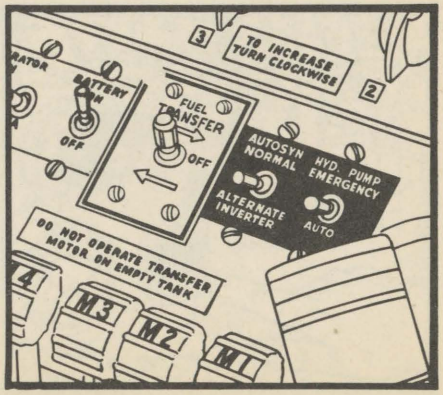
Turn the VOLTMETER SELECTOR switch to AUX. P. P. (auxiliary power plant).

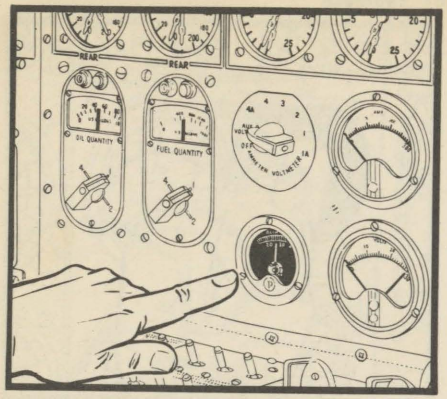


Observe the VOLTMETER for an indication of 28 volts.

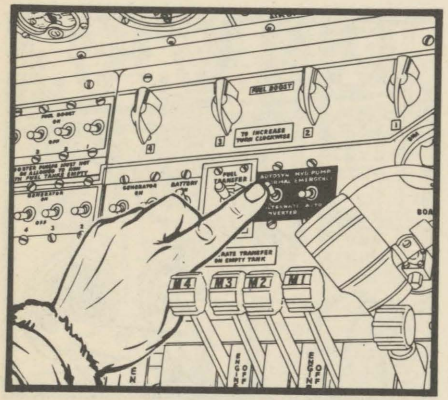


Turn the INVERTER SELECTOR switch to the ALTERNATE position.

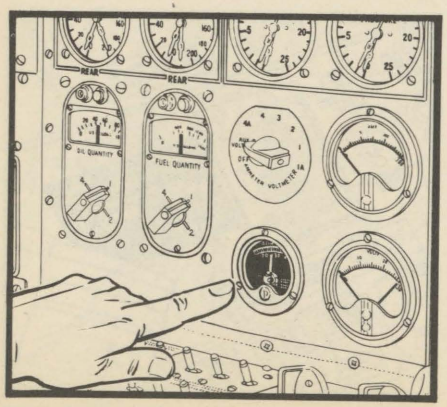




Observe the AUTOSYN VOLTMETER for an indication of 26 volts.

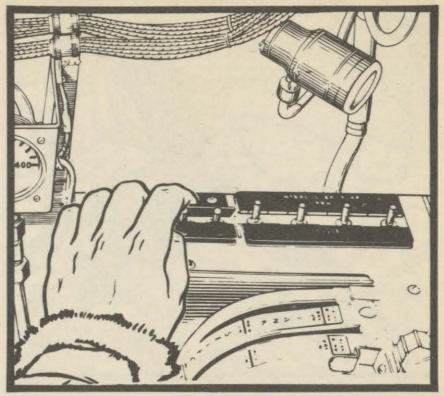


Turn the INVERTER SELECTOR switch to the NORMAL position.

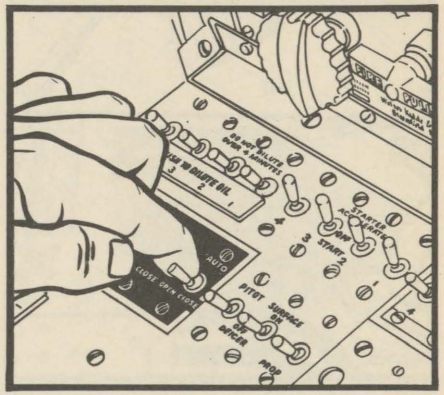


Observe the AUTOSYN VOLTMETER for an indication of 26 volts. The normal inverter will remain in operation. NOTE: When switching from one inverter to another, permit the one just used to stop running.

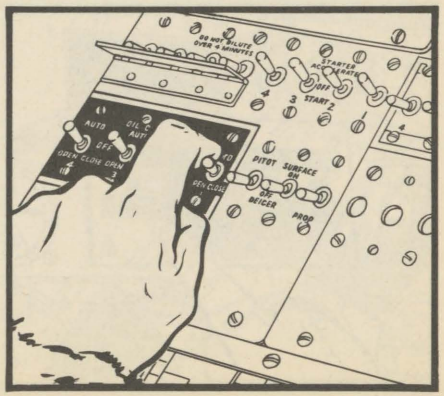
Open the COWL FLAPS to the full OPEN position (5½ inches or 20 degrees). The pointers on the indicators on the instrument panel will go beyond both red lines.

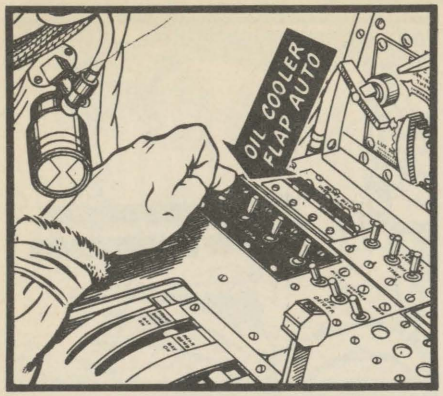


Hold all four OIL COOLER SHUTTER switches at the OPEN position. Have the side gunners visually check and report that the shutters are open.

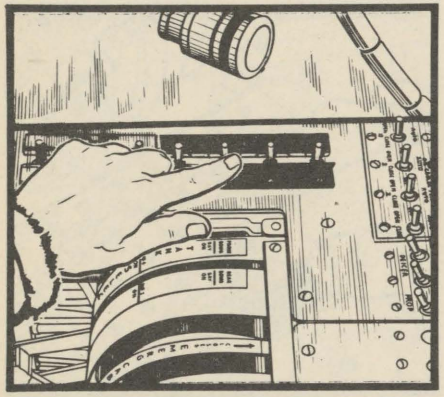


Hold all four OIL COOLER SHUTTER switches at the CLOSE position. Have the side gunners visually check and report that the shutters are closed.

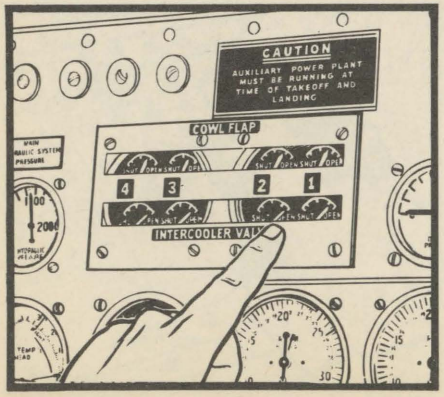




Set the OIL COOLER SHUTTER switches in the AUTO (automatic) position.

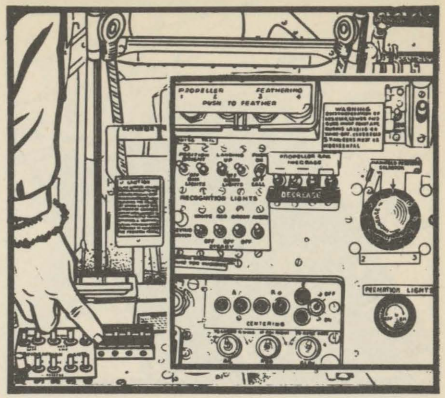


Open the INTERCOOLER SHUTTERS to 4½ inches (15 degrees) and . . . .

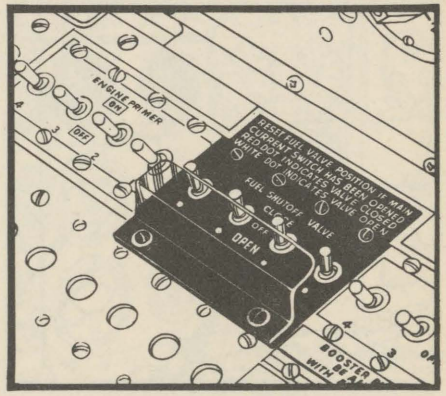


. . . . the indicator pointers on the instrument panel should be on the long red lines.

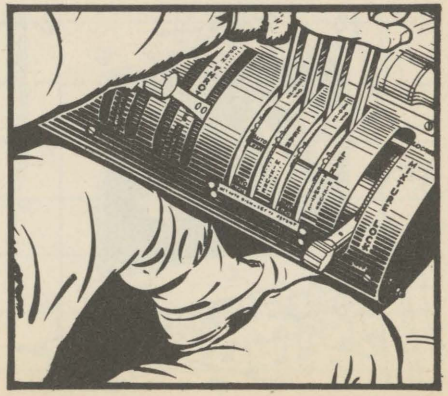
Check to see that the TURBO-SUPERCHARGER CONTROL knob is set at zero and the propellers are at the INCREASE rpm limit.

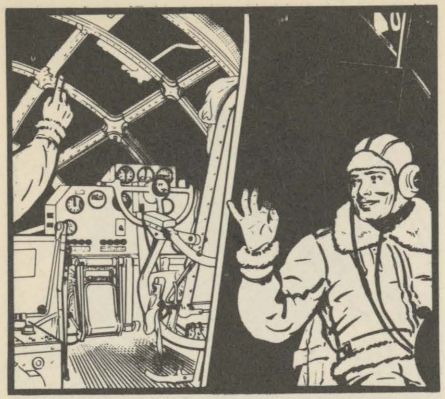


Place the FUEL VALVE switches in the OPEN position. Permit the switches to return to the NORMAL position.

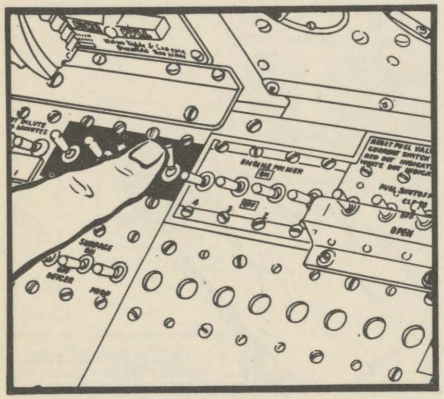


Place the MIXTURE CONTROLS in the IDLE CUT OFF position.

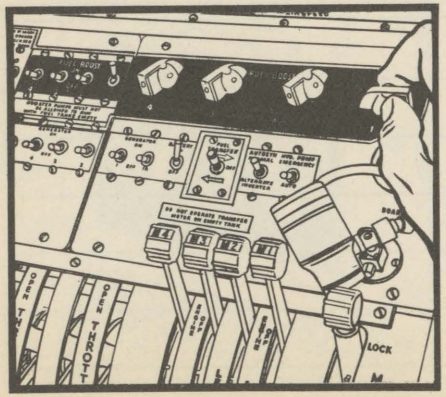




The pilot will inform the flight engineer when he is ready to start each of the engines.

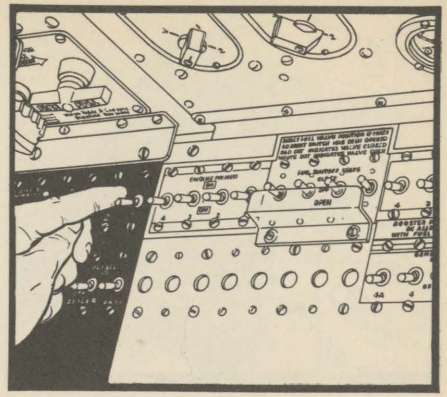


To start engine number 1, hold number 1 STARTER switch at ACCELERATE for five seconds and . . . .

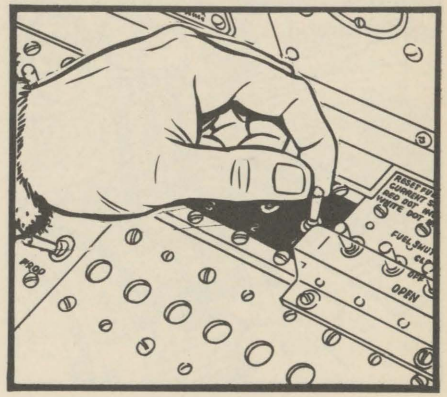


. . . . turn the BOOST PUMP. ON Continue to accelerate for another 10 seconds, then . . . .

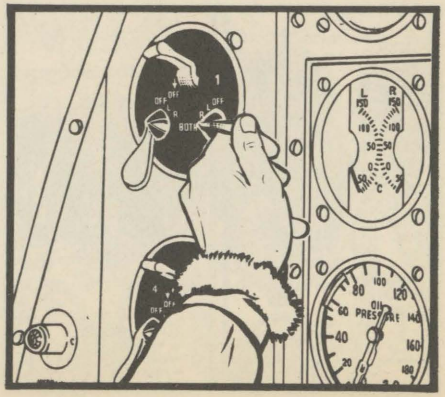
. . . . move the STARTER switch to the START position. This automatically turns the IGNITION BOOSTER ON.

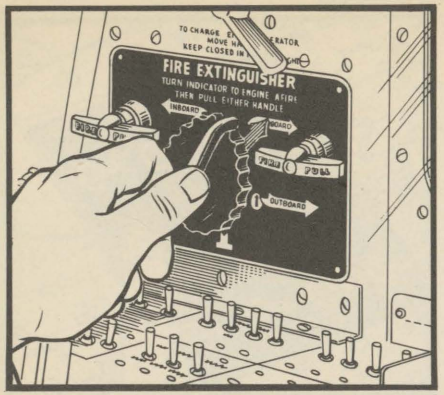


After the propeller has made one turn, hold down the PRIMER 2 to 4 seconds, then release it. AT THE SAME TIME . . . .

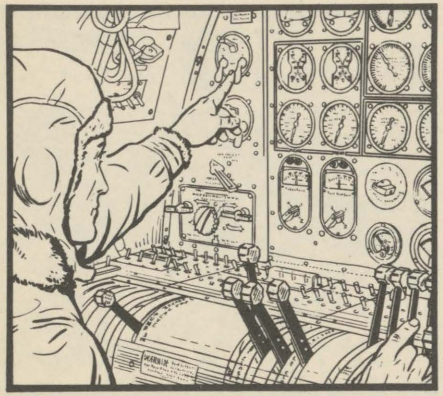


. . . . turn the MAGNETO switch to BOTH.

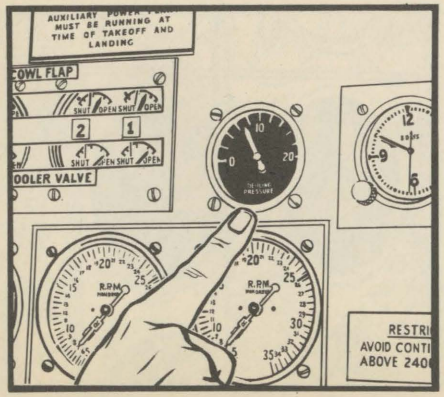




Report to the pilot when ready to start the next engine. Upon receiving an order from the pilot, move the FIRE EXTINGUISHER SELECTOR handle to engine number 2. Repeat the starting procedure for engines 2, 3, and 4.

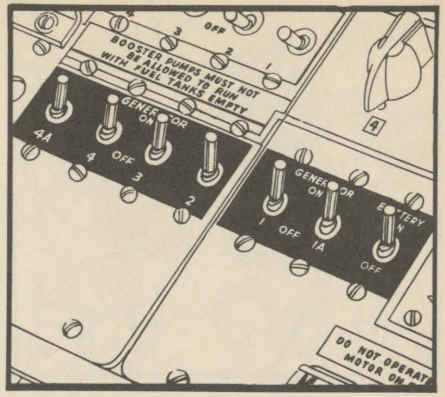


The pilot will control the THROTTLES at his discretion. If an engine fails during starting, move the MIXTURE CONTROL to IDLE CUT OFF and turn the ignition switch to the OFF position. Repeat the starting procedure.

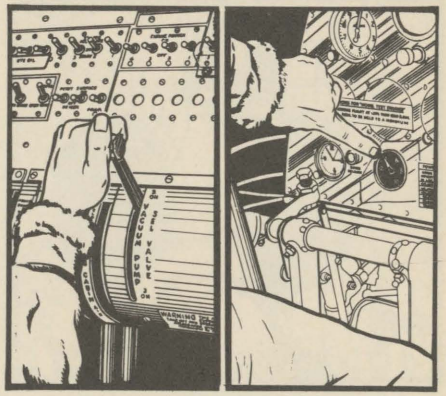


When all of the engines are running, turn the WING DE-ICER switch to the ON position. Check the operation of the de-icer boot segments. If the operation is satisfactory, turn the switch to the OFF position. NOTE: The de-icer air pressure should be between 6½ and 7½ pounds per square inch.

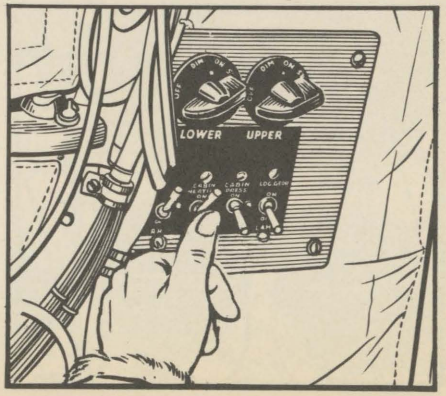
Turn all the GENERATOR switches to the ON position.

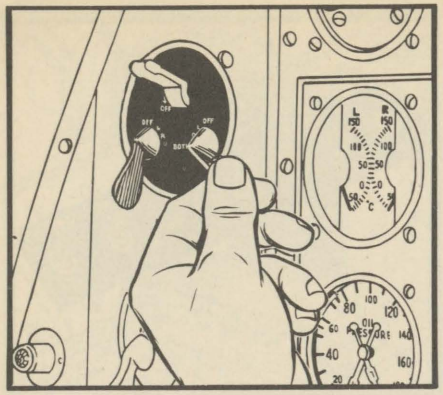


Check the operation of the number 2 and 3 VACUUM PUMPS when directed by the pilot. Normal suction readings should be between 3.8 and 4.2 pounds per square inch.

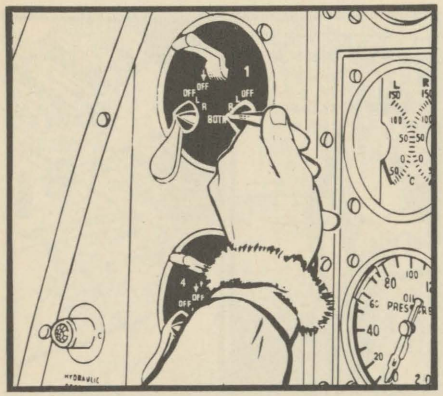


Turn the CABIN HEATING switches to the ON position. Inform the pilot when you are ready for the engine run-up.

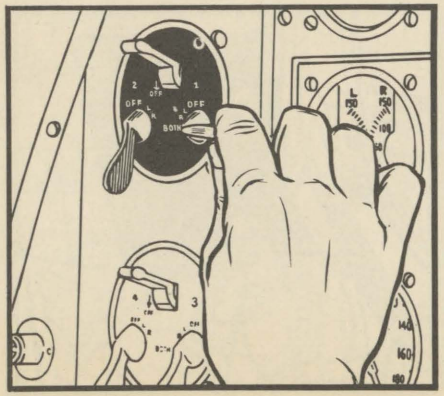




When directed by the pilot, run each engine at 2000 to 2200 rpm. Check the MAGNETO by turning the magneto switch from BOTH to RIGHT. Note the decrease in rpm.

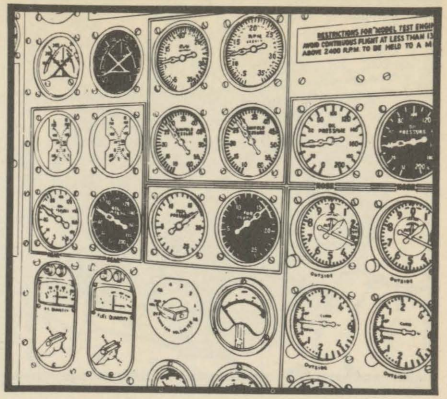


Return the magneto switch to BOTH and permit the engine to regain its lost rpm.

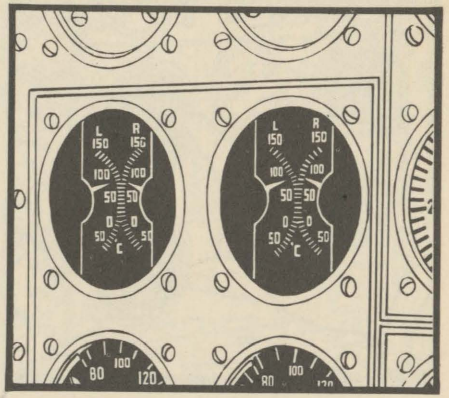


Turn the magneto switch from BOTH to LEFT. Note the decrease in rpm. Return the switch to BOTH as soon as possible. The permissible decrease is not more than 100 rpm.

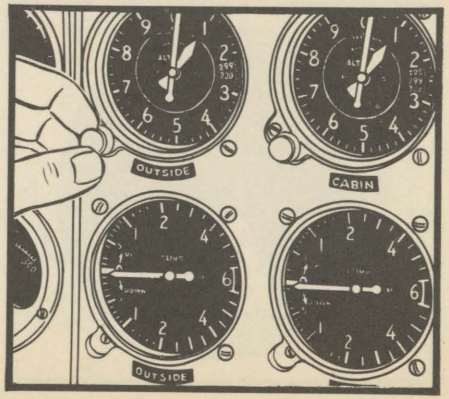
Check the NOSE and REAR OIL PRESSURES, the FUEL PRESSURE, and the CYLINDER HEAD TEMPERATURES.

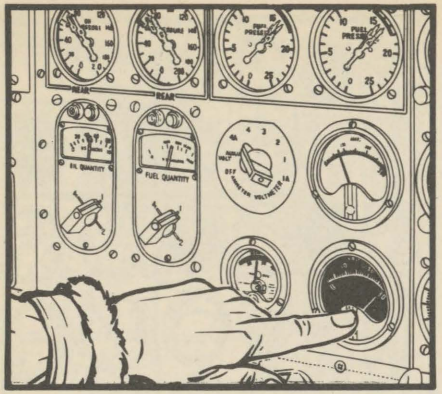


Do not permit any OIL TEMPERATURE to exceed 90 degrees Centigrade. If necessary, control the shutters manually.

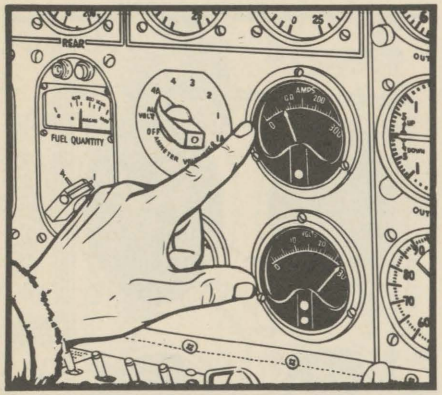


The proper operation of the CABIN PRESSURE RELIEF VALVES is indicated when the altitude indications outside of the cabin are within 100 feet of the indication inside the cabin.

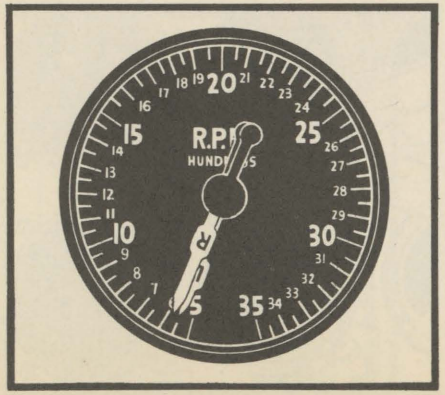




During the magneto check, note the operation of the engine GENERATOR. Voltage should be 28, and . . .

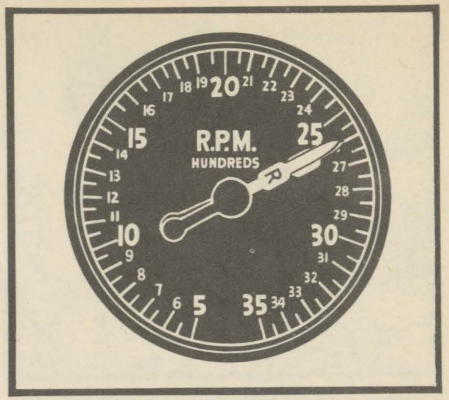


. . . the AMMETER should indicate charge.

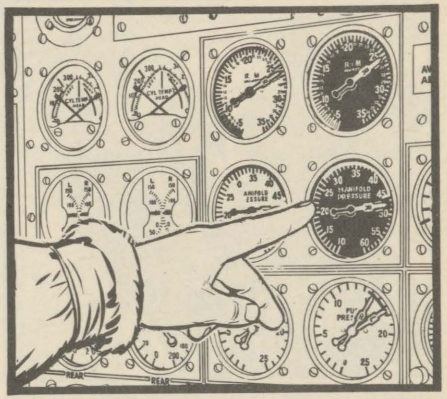


Note that the idling rpm is between 550 and 600, . . .

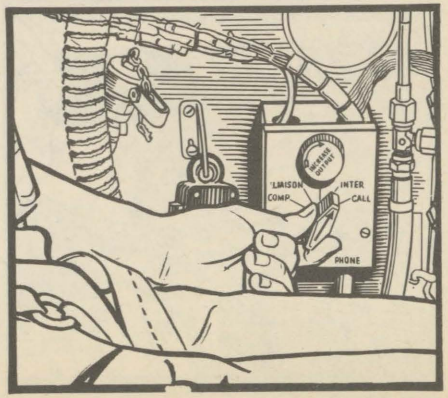
. . . that the maximum rpm is 2600 and . . .

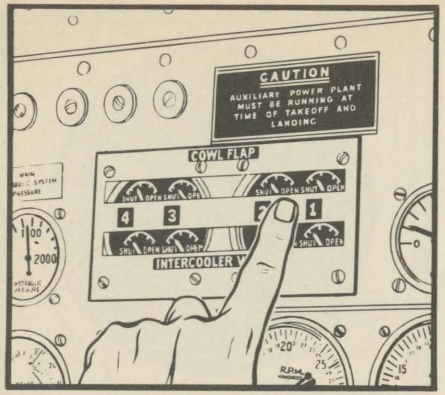


. . . that the maximum PERMISSIBLE MANIFOLD PRESSURE is 47.5 inches of mercury. This will be equivalent to 47 inches of mercury while the engines are run up before flight, due to the effect of "ram" air in flight.

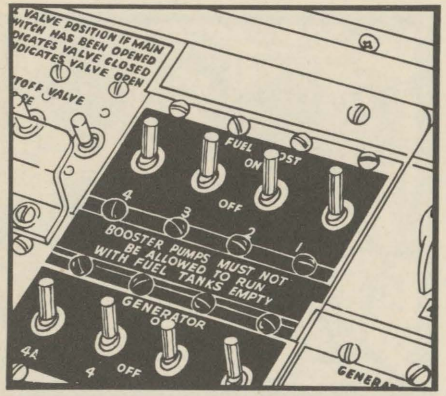


Report to the pilot that all running conditions are normal.

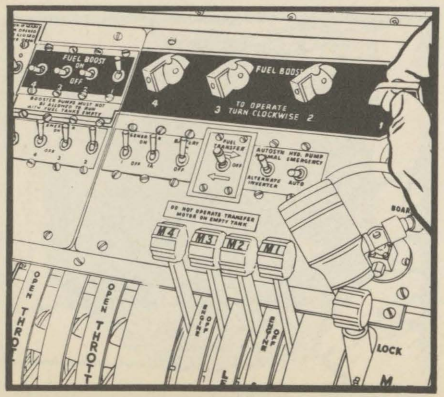




Close the cowl flaps to 15 degrees (open 4½ inches) as indicated by the long red line on the instrument.

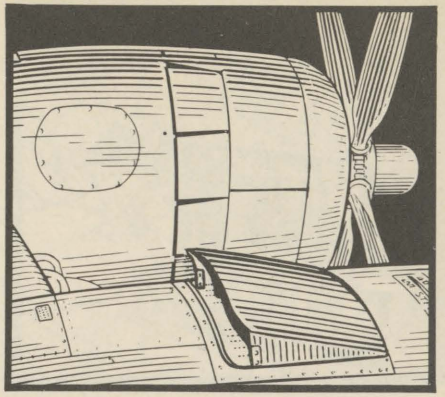


Turn the FUEL BOOSTER PUMP switch to the ON position . . .

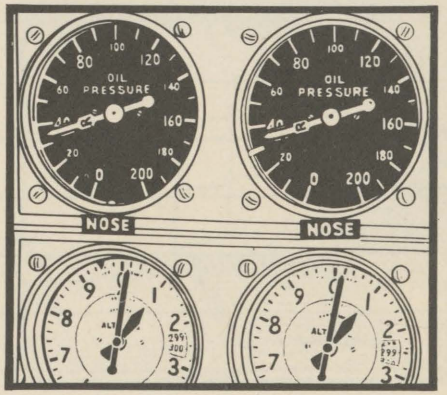


. . . turn the RHEOSTATS to their lowest position, or as required to obtain operating limits.

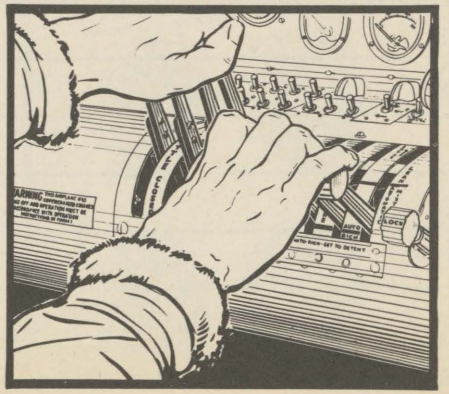
The intercooler shutters should be OPEN for the take-off.



Watch the NOSE OIL PRESSURE. It may be permitted to drop as low as 5 pounds per square inch but should recover immediately after propeller governing.

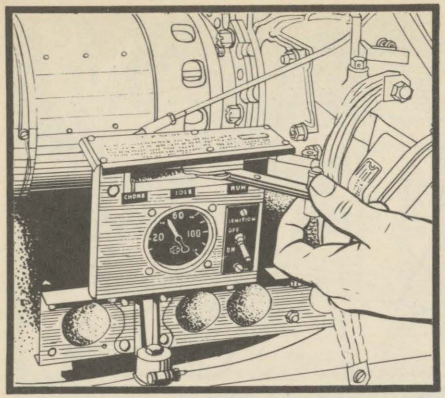


Set the MIXTURE CONTROLS to the AUTO RICH position and . . .



BEFORE TAKE-OFF

FLIGHT ENGINEER

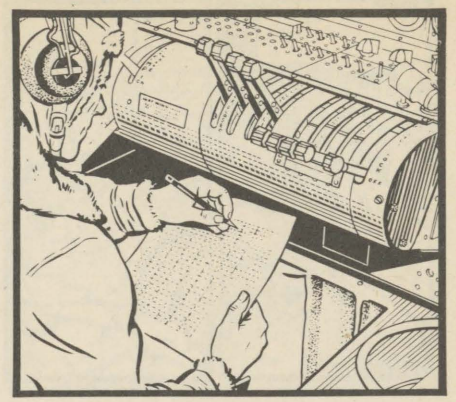


. . . the AUXILIARY POWER PLANT to the HIGH SPEED position.

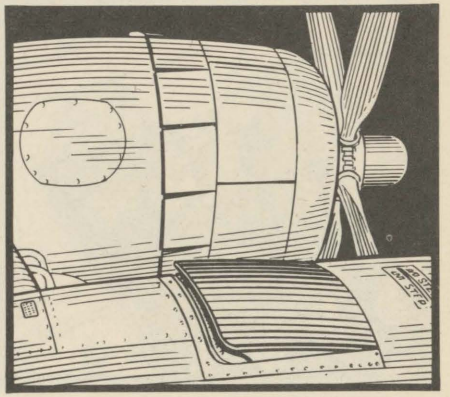
NOTES:

DURING FLIGHT

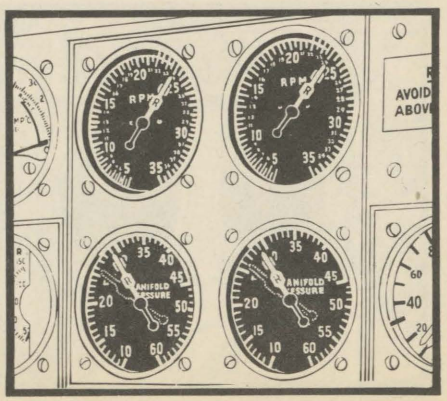
FLIGHT ENGINEER



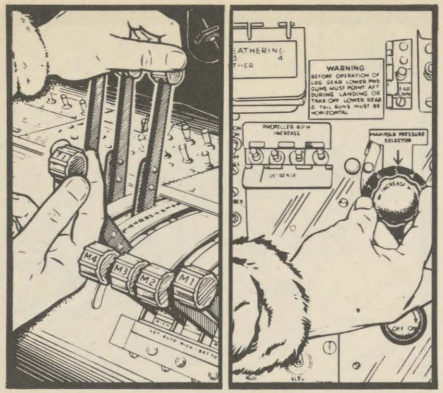
The engineer's log should be posted every 30 minutes during the flight. Changes in engine power or altitude may require additional postings according to the data desired.



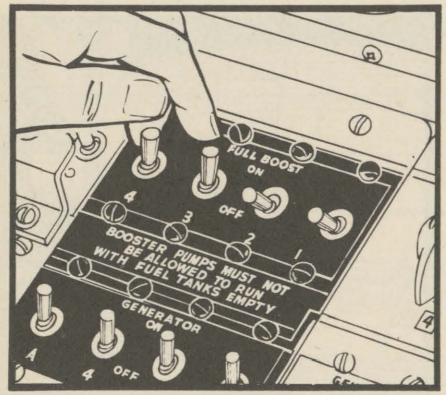
The INTERCOOLER SHUTTERS should be closed to 3 degrees (open one inch) as soon as the TURBOSUPERCHARGER CONTROL knob is in the ZERO position. The shutters should remain in this position until the turbosupercharger is again turned on, or if heat is to be retained for the elimination of ice.



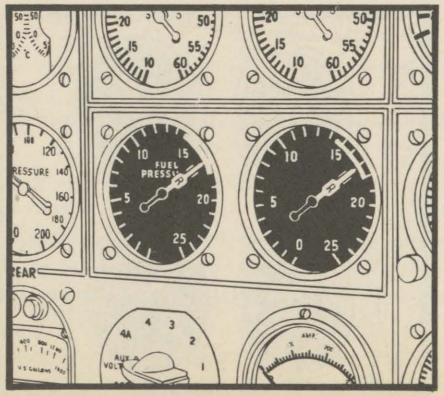
Carburetor icing is indicated if the throttle setting is constant and a drop in manifold pressure is noted.



To eliminate carburetor ice, pull back on the throttles, and maintain manifold pressure with the turbosupercharger. The heat of compressing induction air with the intercooler closed will melt the ice. Carburetor air temperature increase due to the induction filters will be about 5 to 10 degrees Centigrade.

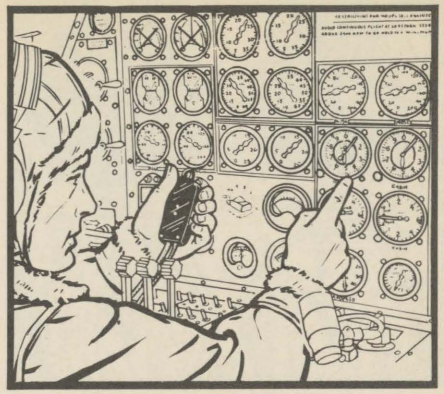


When POWER CONDITION 2 (climbing power) has been established and engine operation is normal, successively turn each FUEL BOOSTER PUMP switch to the OFF position.

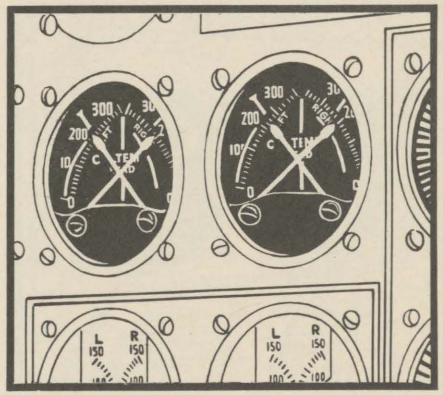


Carefully watch for decrease in FUEL PRESSURE. Do not restart the pumps unless required.

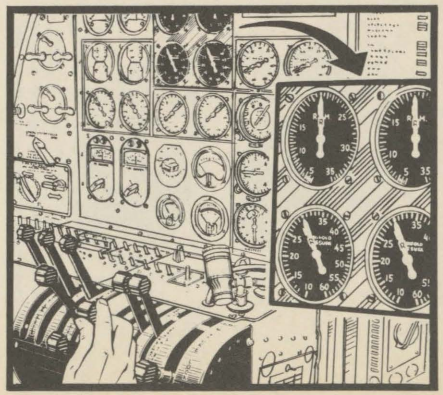
When the airplane reaches an altitude of 5000 feet, or as soon as it is leveled off, request permission from the co-pilot to order the AUXILIARY POWER PLANT stopped.

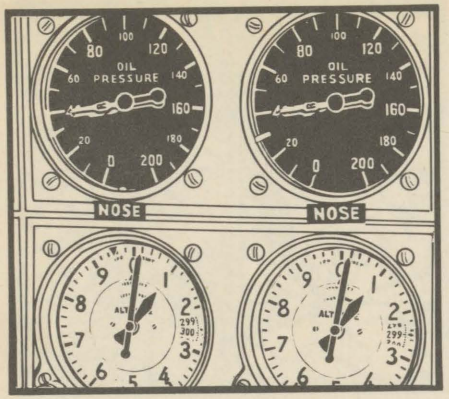


When the CYLINDER HEAD TEMPERATURE is 210 degrees Centigrade (or lower), close the COWL FLAPS to 7½ degrees. A short red line on the cowl flap indicator shows this position. These flaps should be closed whenever possible.

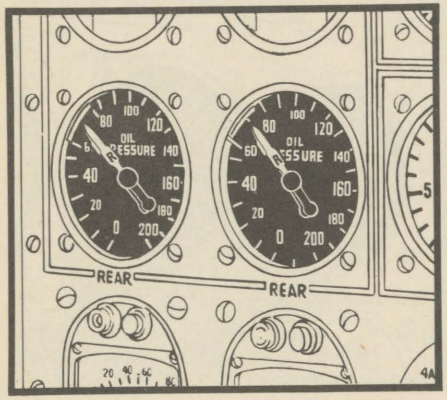


As soon as the power is reduced to 2000 rpm and 30 inches of mercury, successively move each MIXTURE CONTROL to the AUTO LEAN position. Note any change in power.

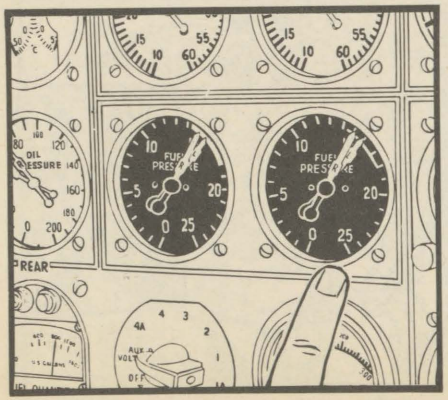




Observe the NOSE OIL PRESSURE. (Operating limits are 30 to 50 pounds per square inch.) Any variation or drop in the pressure indicates excessive propeller governing.

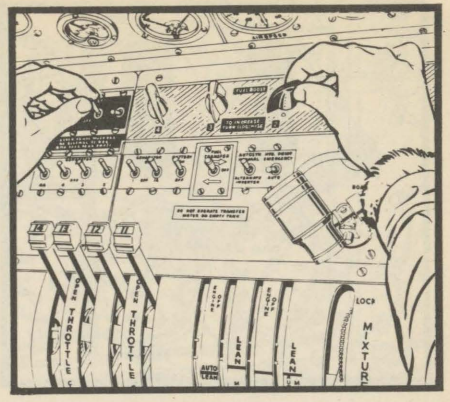


Observe the REAR OIL PRESSURE. (Operating limits are 60 to 80 pounds per square inch.)

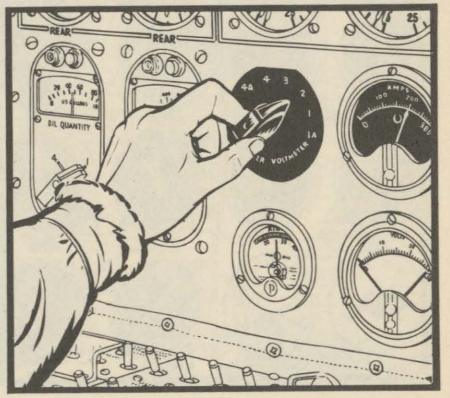


Observe the FUEL PRESSURE. (Operating limits are from 15 to 18 pounds per square inch.)

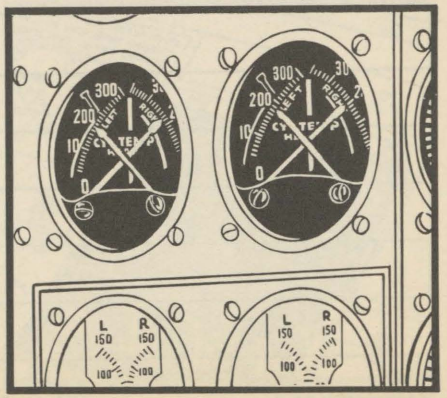
Turn the FUEL BOOST PUMPS to the ON position and adjust them with the RHEOSTATS to maintain proper operating limits.

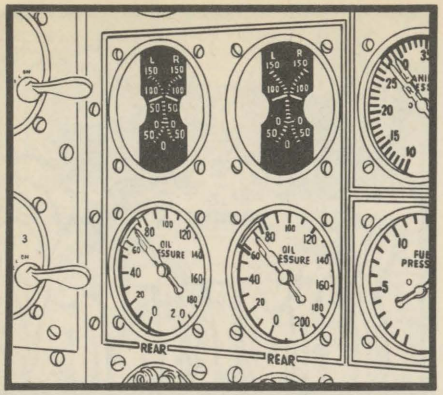


Check all the GENERATORS. The voltage should not exceed 28.5. The generators will cause the AMMETER to show a charge as required by the electrical load. However, the charge should not exceed 200 amperes.

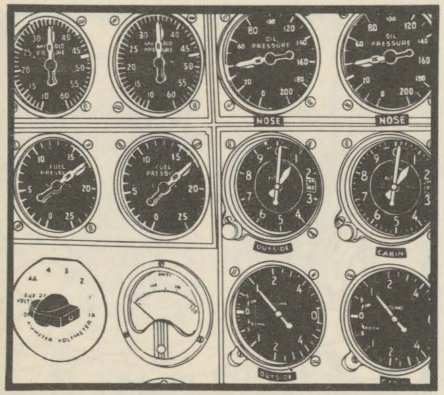


Check the CYLINDER HEAD TEMPERATURES. Adjust the COWL FLAPS to maintain temperatures not to exceed 210 degrees Centigrade.





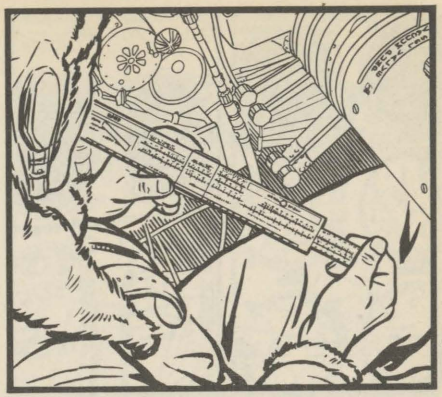
Constantly observe all of the OIL TEMPERATURES. (Operating limits are 50 to 90 degrees Centigrade.) If the AUTOMATIC SHUTTERS do not maintain these limits, operate them manually.



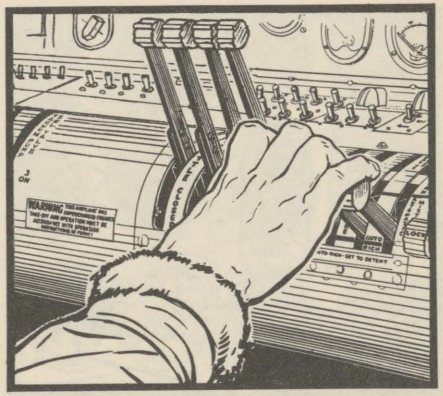
Immediately notify the pilot of any equipment that does not function properly. Maintain a constant check on the CABIN SUPERCHARGING SYSTEM.

NOTES:

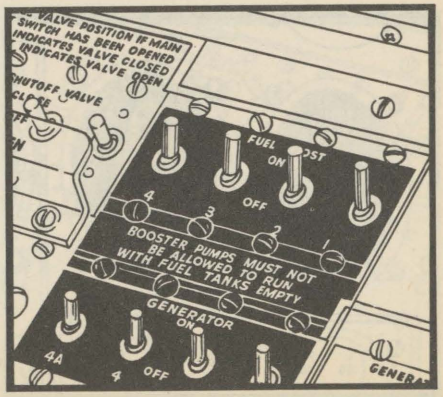
Compute the gross weight and center of gravity of the airplane. Report the results to the co-pilot. Order the AUXILIARY POWER PLANT started, and set it in high speed operation as soon as it is warm.

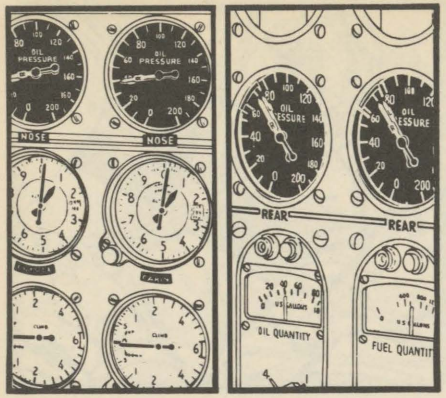


Place the MIXTURE CONTROLS in AUTO RICH and . . .

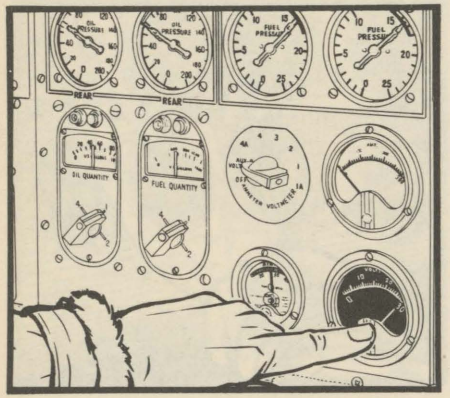


. . . turn the FUEL BOOST PUMPS to the ON position.

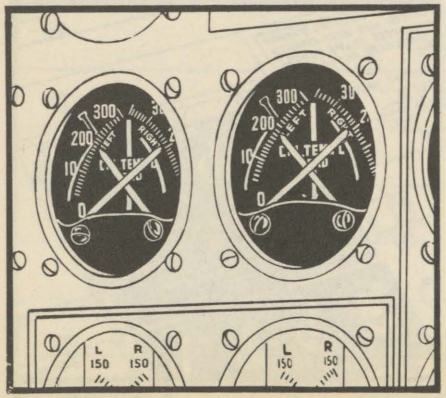




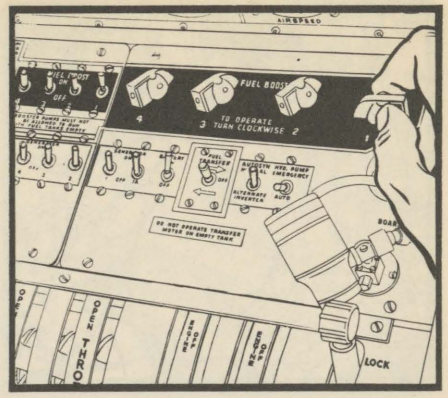
Watch the NOSE OIL PRESSURES and the REAR OIL PRESSURES.



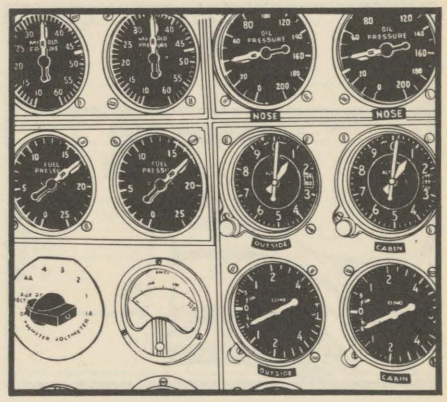
All GENERATORS should supply 28 volts and the proper amount of amperage by load conditions.



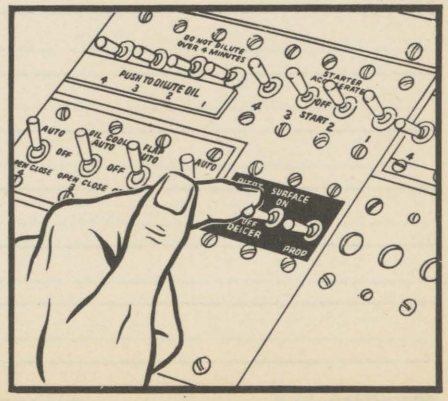
The CYLINDER HEAD TEMPERATURES should be held at about 210 degrees Centigrade since a glide with power off may cause rapid cooling of the engines.



If necessary, adjust the rheostat to a FUEL PRESSURE of 14 to 16 pounds per square inch.



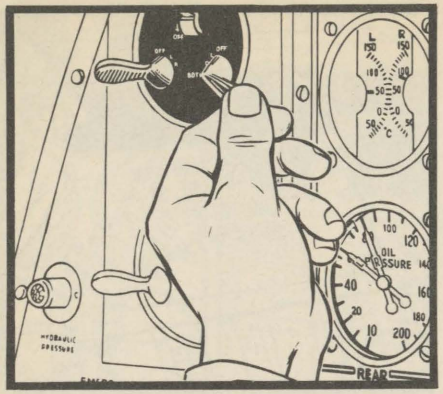
If cabin heating is desired, leave the CABIN HEATING switches in the ON position. The CABIN altitude and the OUTSIDE altitude indication should be within 100 feet of each other.



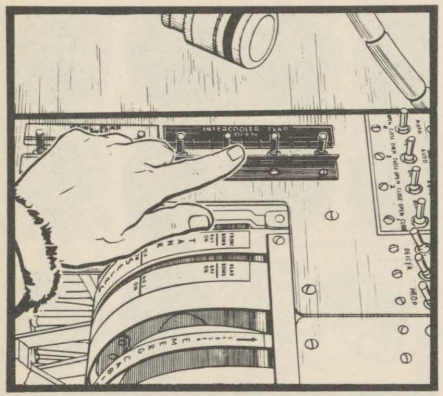
Turn the WING DE-ICERS to the OFF position. The HYDRAULIC SYSTEM pressures should be 1000 pounds per square inch.

BEFORE LANDING

FLIGHT ENGINEER



Check the MAGNETOS. The permissible drop in rpm is 100.



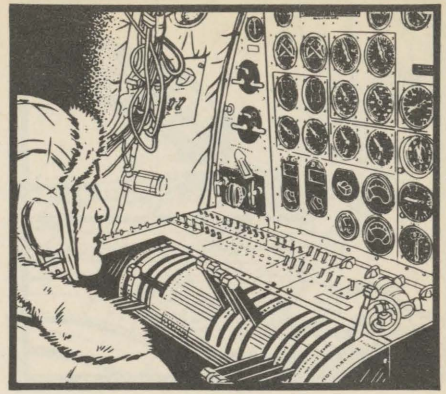
Open the INTERCOOLER SHUTTERS to 15 degrees when the turbosupercharger is turned on unless carburetor heat is required for vaporization of the fuel.

NOTES:

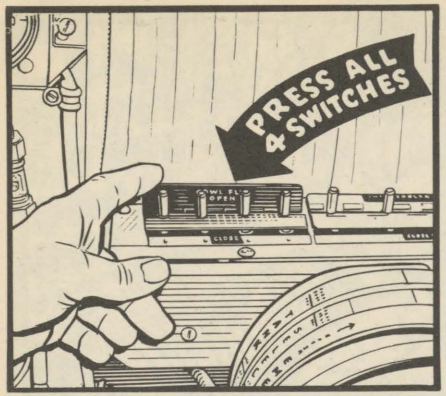
DURING LANDING

FLIGHT ENGINEER

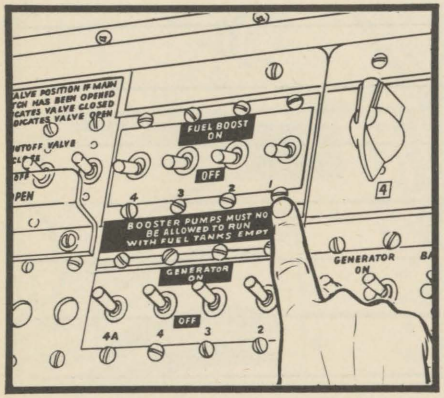
Watch all instrument indications. Be alert and ready to make the required adjustments should the pilot decide to maintain or resume flight.



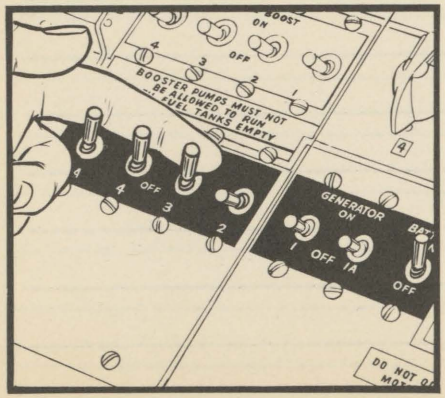
NOTES:



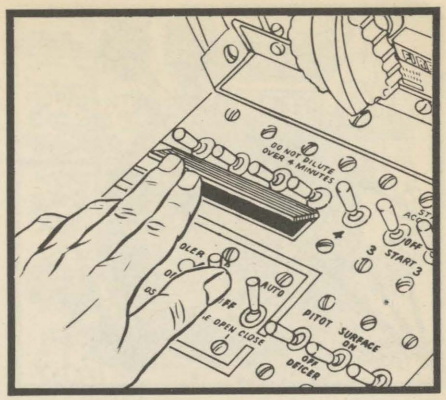
Set the COWL FLAP switches to the full OPEN position.



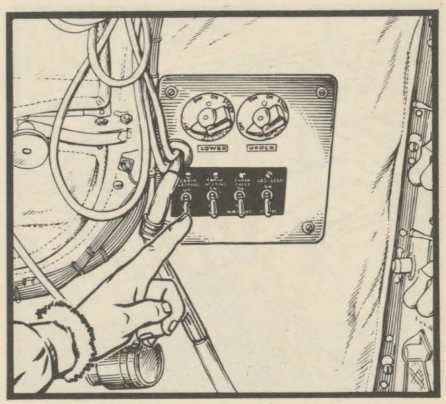
Turn the FUEL BOOST PUMPS to the OFF position.



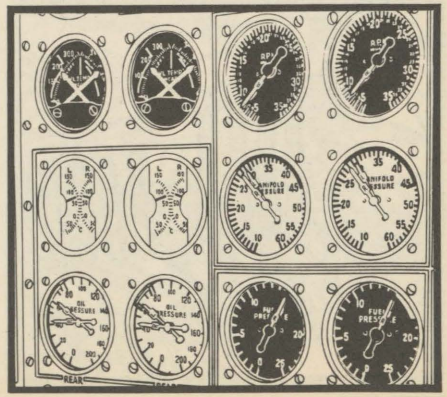
Turn the GENERATORS to the OFF position after the WING FLAPS have been retracted.



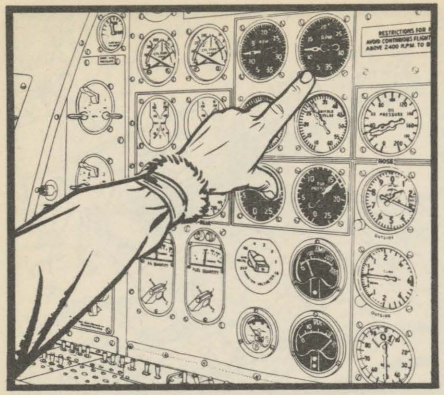
If required by weather conditions, press all the OIL DILUTION switches until the OIL PRESSURE decreases at least 10 pounds per square inch.



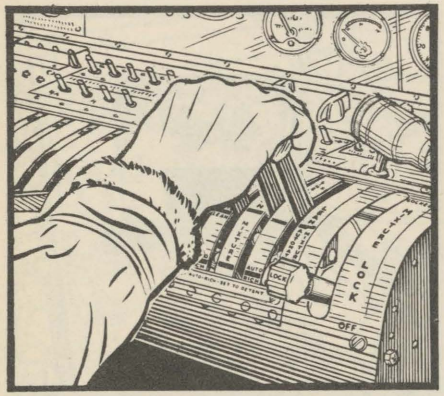
Turn the CABIN HEATER switches to the OFF position.



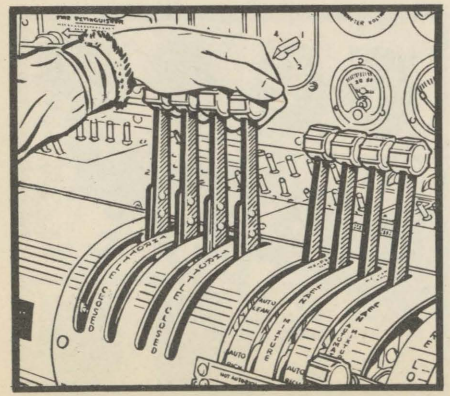
Run the engines at 800 rpm until the CYLINDER HEAD TEMPERATURES decrease to at least 190 degrees Centigrade.



Increase the THROTTLE settings to 1200 rpm. Run each engine at this speed for 30 seconds and . . .

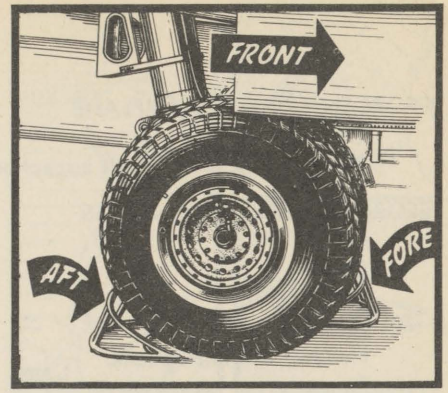


. . . move the MIXTURE CONTROLS to the IDLE CUT OFF position. As soon as the engines stop . . .

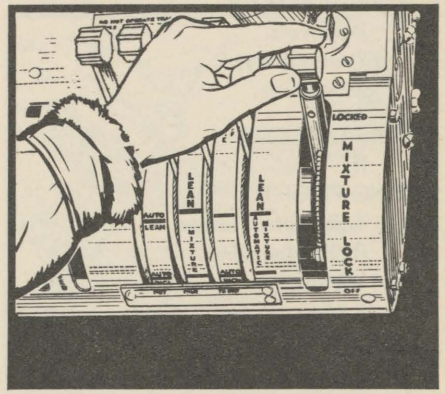


. . . slowly push all of the throttles to the full OPEN position. Turn all switches to the OFF position.

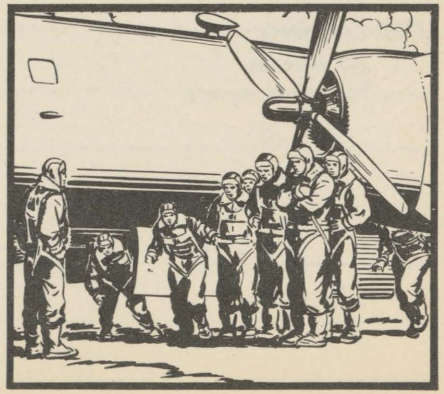
Check to see that the parking brakes are OFF. Parking brakes must not be applied until the brake drums are cool. See that the wheels are properly chocked fore and aft.



Order the AUXILIARY POWER PLANT stopped. See that all controls are locked.



When instructed by the pilot, leave the airplane and join the formation for inspection by the pilot.



RADIO OPERATOR'S CHECK LIST

BEFORE ENTERING THE AIRPLANE
- Check antennas.
- Personal effects for pilot's inspection.

BEFORE STARTING THE ENGINES
- Charts.
- Codes.
- Blinker lights.
- Antennas.
- Headset and microphone.
- Frequency.

DURING WARM-UP
- Receivers.
- Transmitters.
- Interphone.

BEFORE TAKE-OFF
- IFF

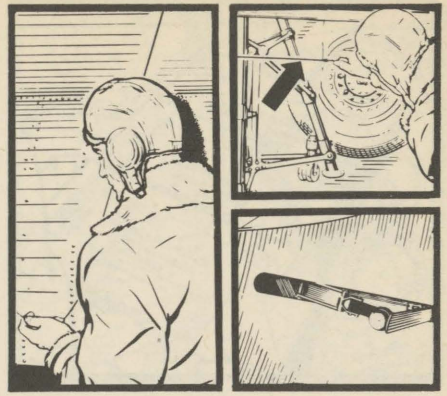
DURING FLIGHT
- Transmitter (liaison).
- Radio discipline.
- Marker beacon.
- Radio compass.

BEFORE LANDING
- IFF
- Trailing wire.

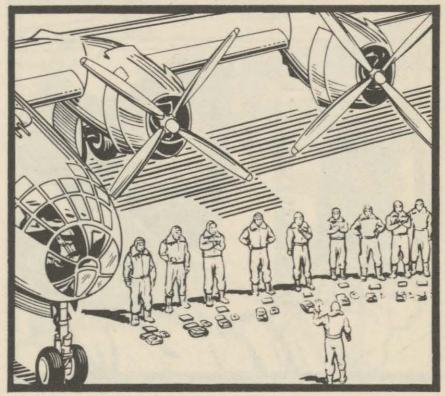
AFTER LANDING
- All switches.
- Formation reports.

BEFORE ENTERING THE AIRPLANE

RADIO OPERATOR

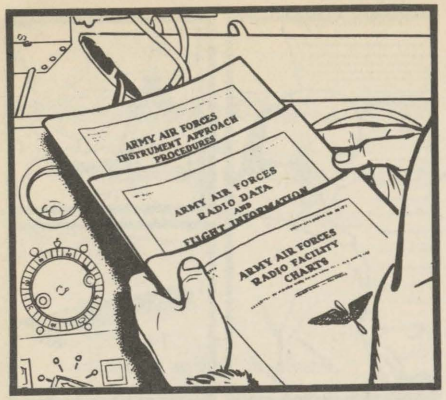


Visually check all antennas for general appearance. Consult the daily check list to ascertain that each aerial was checked for broken leads or insulators, loose connections, corrosion, and nicks.



Prepare your personal effects for the pilot's inspection.

NOTES:



Be sure that the FACILITY CHART, AID TO NAVIGATION, and AAF INSTRUMENT APPROACH PROCEDURES are in the airplane. Check the signal operations file for the following:

(a) RADIO AUTHENTICATION.

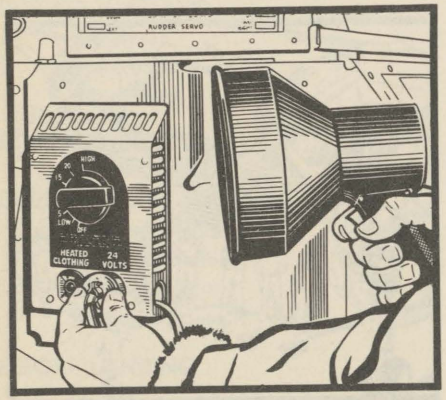
(b) SPECIAL CODES (for the day).

(c) WEATHER CODES.

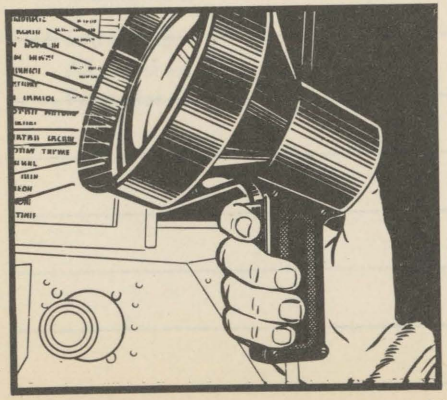
(d) BLINKER CODES.

(e) RADIO CALL SIGNS.

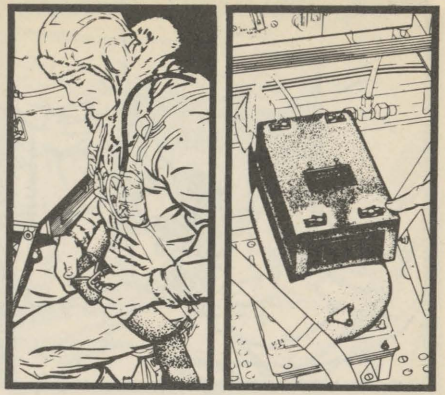
IMPORTANT: Read SOI file for instructions and changes.



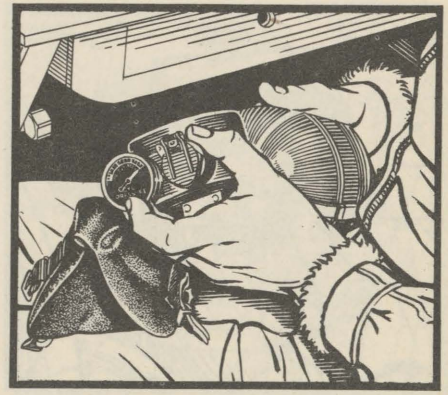
Remove the BLINKER light (Aldis lamp) from its container and connect the plug to the 24-volt outlet which is on all heated flying suit control boxes.



Check the operation of the ALDIS LAMP and if it is found to be operating satisfactorily, replace it in its container. NOTE: The container should always be stowed securely during take-off.



Adjust your seat and safety belt. Stow your PARACHUTE and other equipment within easy reach. NOTE: Do not place any equipment on top of the DYNAMOTOR; ventilation is required to prevent overheating while it is running.



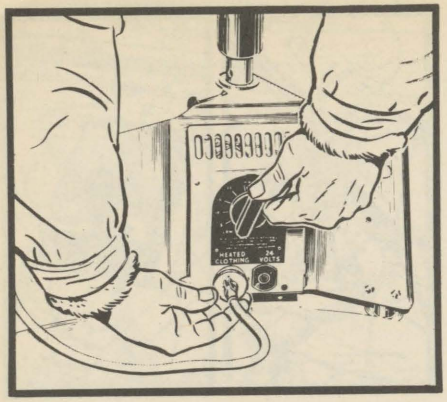
See that a fully charged PORTABLE OXYGEN BOTTLE is within easy reach. Oxygen pressure should be 400 to 425 pounds per square inch. Your OXYGEN MASK should be placed within easy reach.



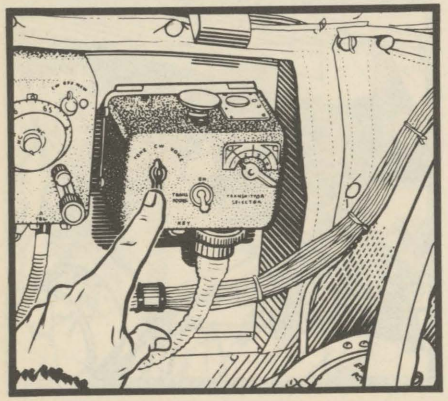
Adjust your EARPHONES and THROAT MICROPHONE.

BEFORE STARTING THE ENGINES

RADIO OPERATOR



Plug in the connector of your HEATED FLYING SUIT. Be sure that the RHEOSTAT is in the OFF position. Try the various circuits. Be sure that each circuit operates properly and that the elements in your suit supply heat.



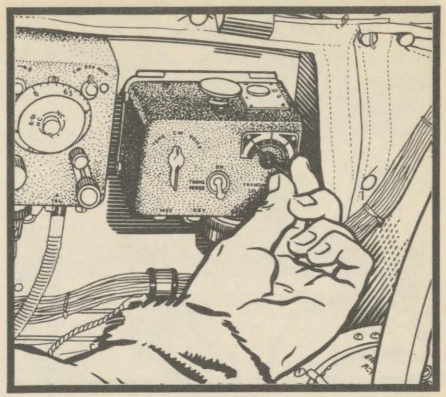
Ask the pilot to set his COMMAND CONTROL BOX to the CW position.

NOTES:

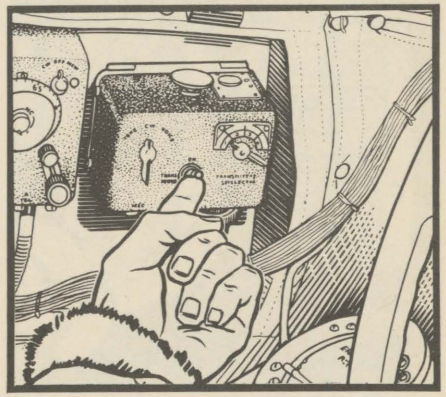
DURING WARM-UP

RADIO OPERATOR

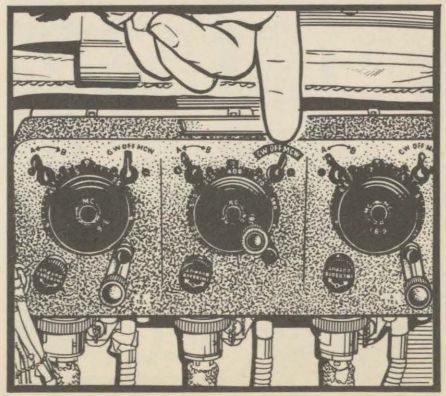
Turn the TRANSMITTER SELECTOR SWITCH to the desired transmitter and . . .

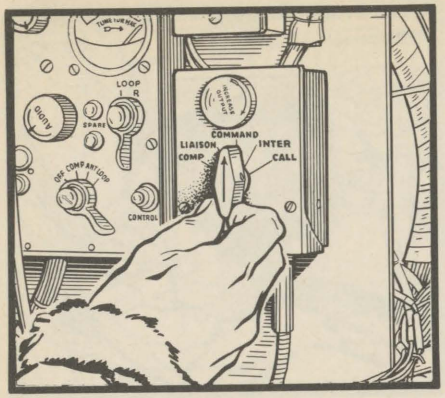


. . . turn the TRANS POWER switch to the ON position.

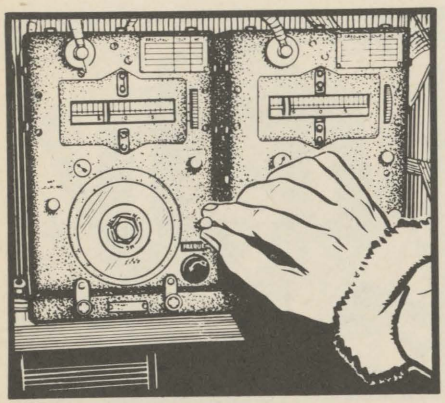


Turn the proper command receiver CW-OFF-MCW switch to the MCW position. NOTE: The forward receiver operates on 3000 to 6000 Kc. The center receiver operates on 190 to 550 Kc. The rear receiver operates on 6000 to 9100 Kc.

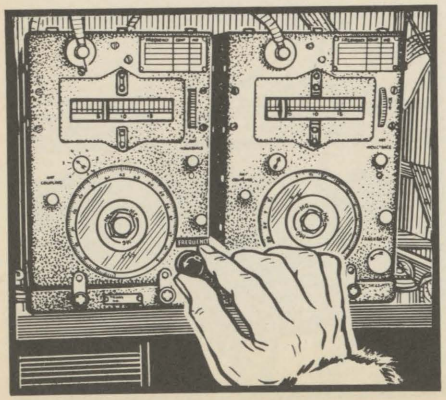




Turn the JACK BOX SELECTOR switch handle to the COMMAND position . . .

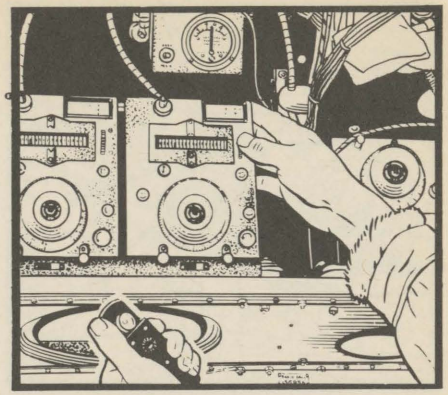


. . . unlock the FREQUENCY DIAL with the LOCK KNOB.

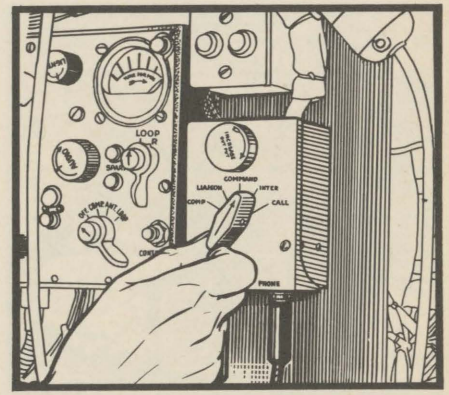


Set the TUNING DIAL to the desired frequency.

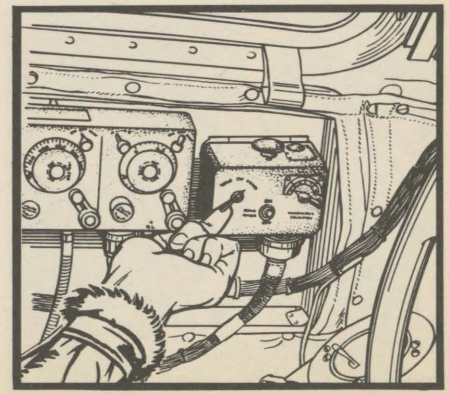
With the microphone switch depressed, tune (1) to maximum inductance and (2) to maximum antenna coupling by noting the highest reading on the ANTENNA CURRENT METER switch is located above the command transmitters. (Maximum antenna current indication is above mid-scale.) NOTE: Relock the frequency dial with the lock knob.

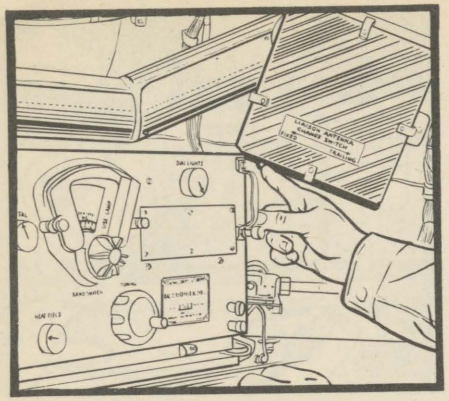


Turn the JACK BOX SELECTOR switch to INTER (interphone).

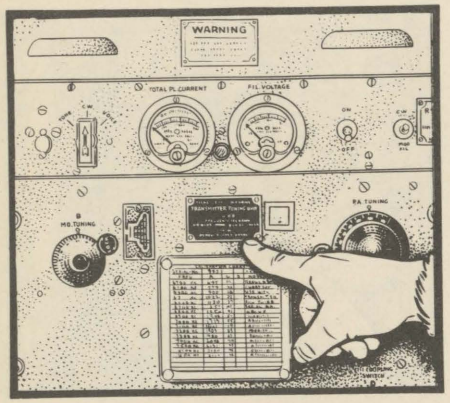


Inform the pilot that the COMMAND TRANSMITTER is tuned. The pilot should turn his COMMAND CONTROL BOX switch to the VOICE position.

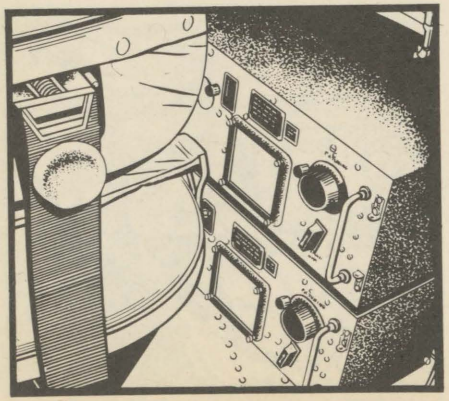




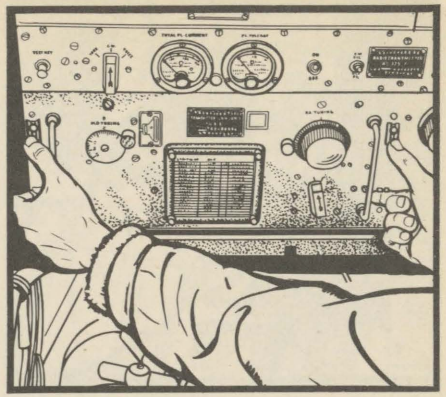
Make sure that the switch on the LIAISON ANTENNA CHANGE BOX is locked into the jaws at FIXED before proceeding to tune the LIAISON RADIO.



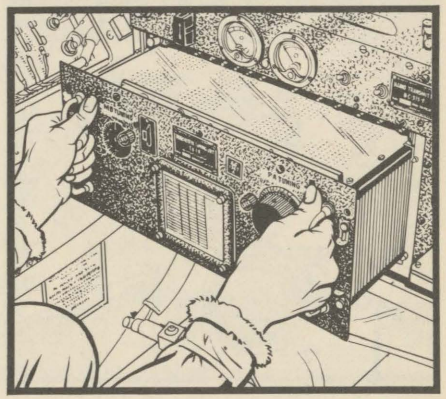
Check to see that the TUNING UNIT covering the desired transmitting frequency is installed in the transmitter. NOTE: The frequency range covered by the tuning unit is on the name plate attached to the front of the unit.



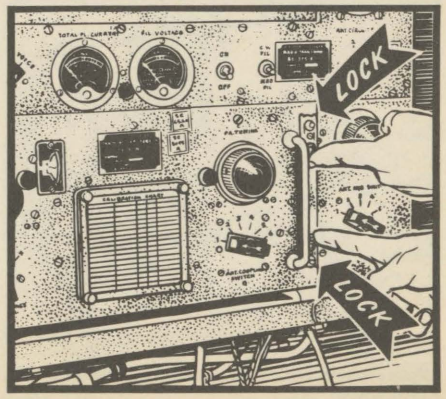
Two additional tuning units are stowed under the table.



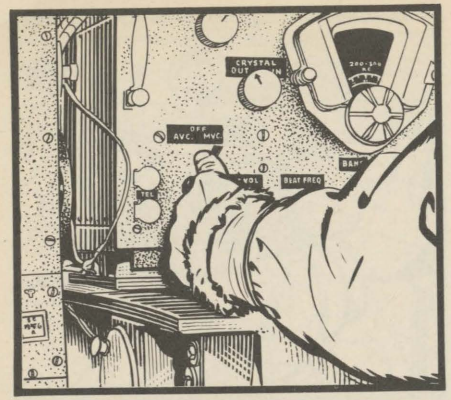
If necessary to exchange tuning units, remove the unit by pulling the locks on the side of the unit toward each other and . . .



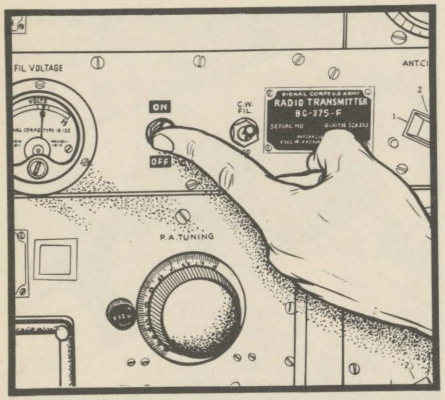
. . . grasp the unit by the handles and pull it straight out.



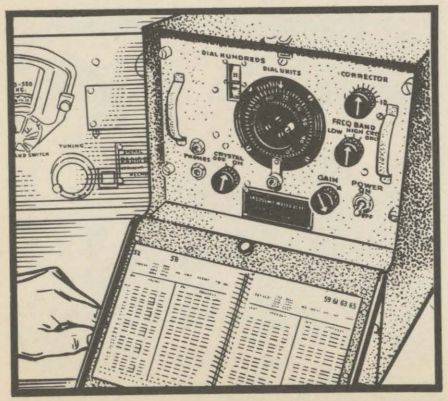
Replace the unit just removed with the unit covering the desired frequency. Lock the snap slides.



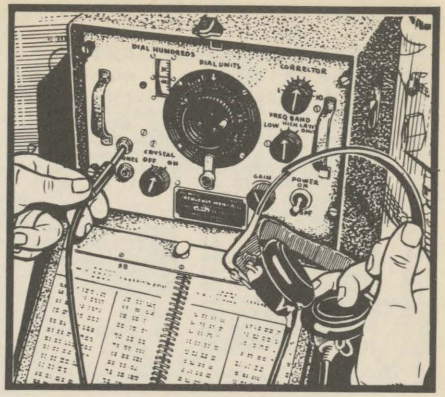
Turn the LIAISON RECEIVER to the MVC position.



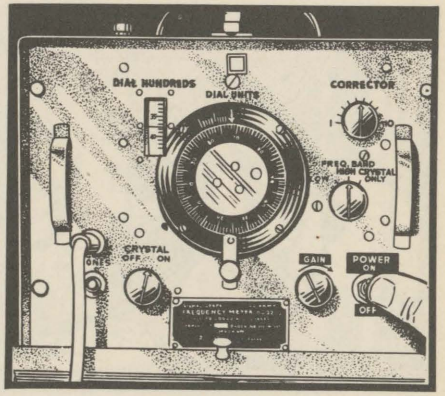
To tune the LIAISON TRANSMITTER, place the power switch to the ON position. NOTE: The filament voltage pointer should rise to 10.



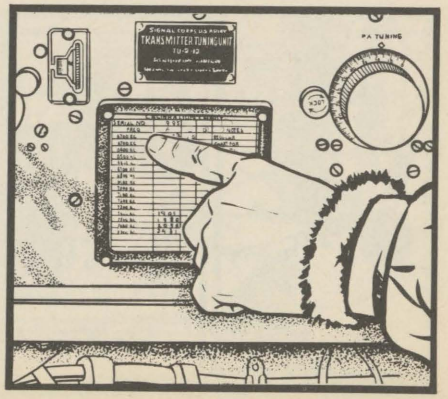
Remove the FREQUENCY METER from the stowed position and set it on the table in front of the receiver.



Plug the headset provided with the frequency meter into the PHONE jack.



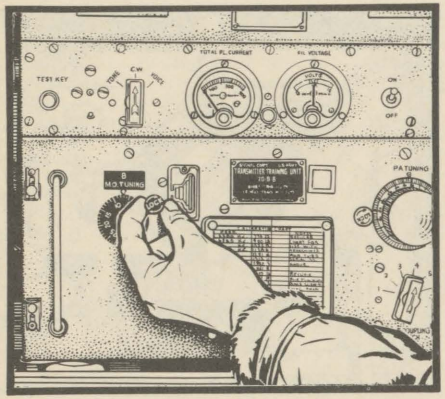
Turn the POWER SWITCH on the frequency meter to the ON position.

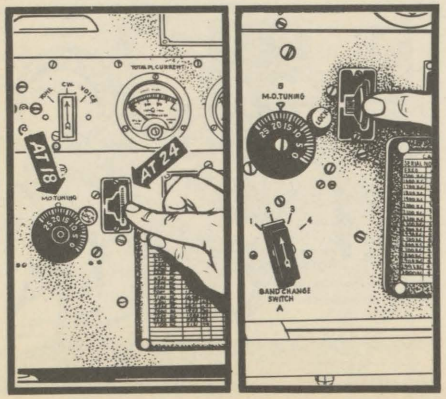


Check for the desired frequency on the calibration chart attached to the front of the tuning unit.

CALIBRATION CHART

FREQUENCY	A	B	C	D	NOTES
1500 KC	1	1261	50		REGULAR CHART FOR USE WITH TRANSMITTER SERIAL No. 53 TU-5-A SERIAL No. 53
1600 KC	2	369	21		
1700 KC	2	1320	50		
1800 KC	2	2113	75		
1900 KC	3	690	32		
2000 KC	3	1271	50		
2100 KC	3	1773	65		
2200 KC	3	2216	78		
2300 KC	4	436	25		RETUNE "C" FOR MINIMUM PLATE CURRENT AFTER ANTENNA IS TUNED TO RESONANCE.
2400 KC	4	755	35		
2496 KC	4	1023	44		
2500 KC	4	1035	44		
2600 KC	4	1289	52		
2700 KC	4	1517	59		
*2800 KC	4	1722	65		
*2900 KC	4	1907	71		ORDER No. 51-NY-40
2994 KC	4	2068	76		
3000 KC	4	2078	76		





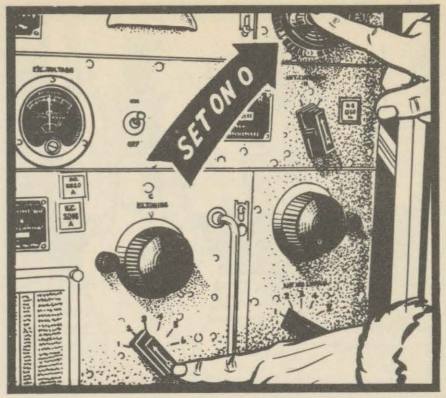
As an example, the desired operating frequency is 2855 Kc.; tuning unit TU-5-(A) would be used. If the desired frequency does not appear on the calibration chart interpolate the frequency as follows:

1. Desired operating frequency, 2855 Dc.
2. Dial setting B for nearest listed frequency (2900 Kc.,) 1907
3. Dial setting B for nearest listed lower frequency (2800 Kc.,) 1722
4. Frequency variation, 100; dial setting variation, 185
5. Dial variation per kilocycle, 1.85
6. Interpolation multiplier, 2855 — 2800 = 55
7. Interpolation product (dial units), 1.85 × 55 = 101.75
8. Interpolated dial setting, 1722 + 102 = 1824

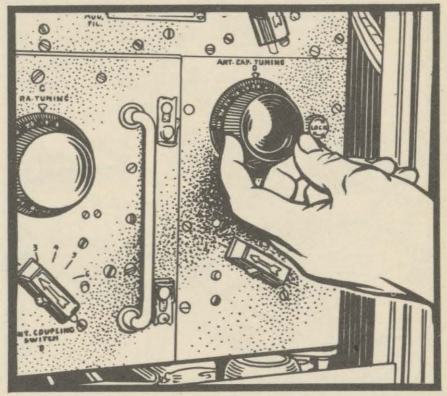
Unlock all TUNING CONTROL LOCKS.

Set dial B for 2855 Kc. by turning the units dial until a reading of 18 is shown on the hundreds scale, and a reading of 24 is shown on the units scale.

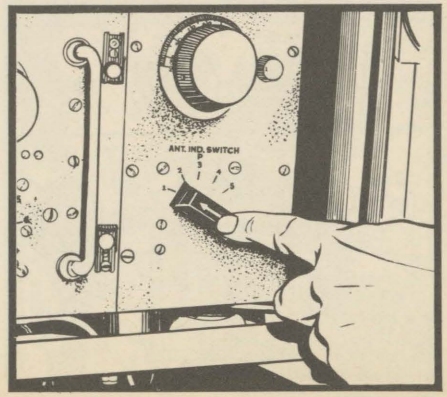
Set the ANT. COUPLING SWITCH D to position 2. Set the ANT. IND. (antenna inductance) TUNING dial M on 0. NOTE: Follow this tuning procedure when using TUNING UNITS TU-5 (A) to TU-10-(B).

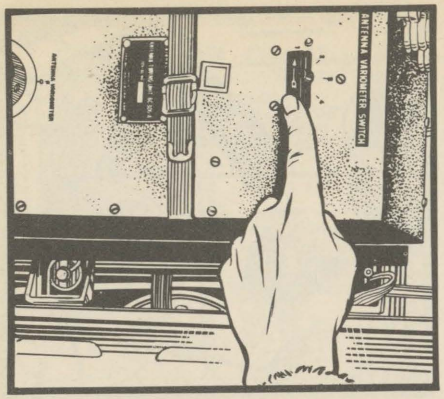


Set the ANT. CAP. (antenna capacitance) TUNING dial O on 50.

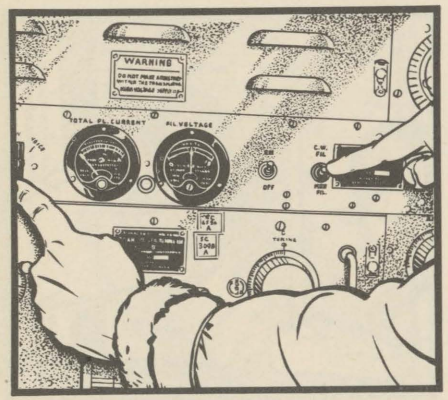


Set the ANT. IND. SWITCH P on position 1.

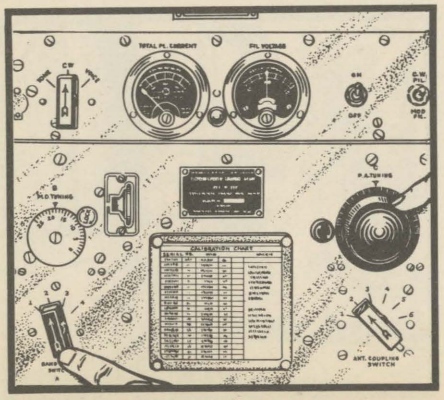




Set the ANTENNA VARIOMETER SWITCH E on the ANTENNA TUNING UNIT to position 1.

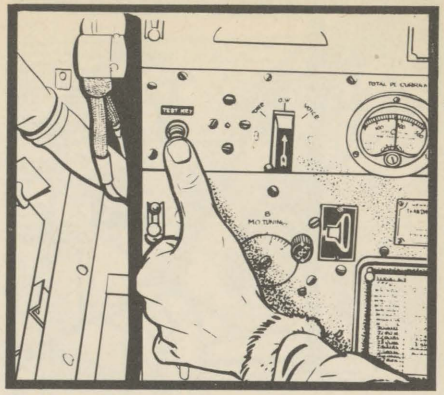


Set the TONE-CW-VOICE switch to the CW position. Set the CW-FIL-MOD-FIL switch to the CW FIL position.

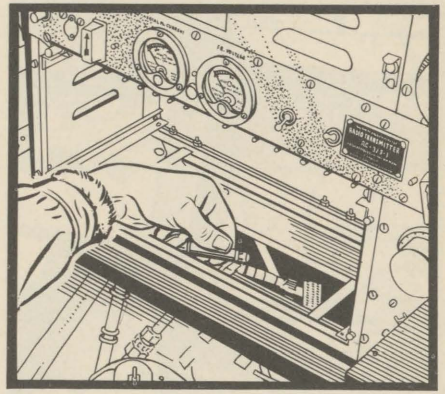


Set BAND CHANGE switch A and P.A. TUNING dial C in accordance with readings indicated on the calibration chart.

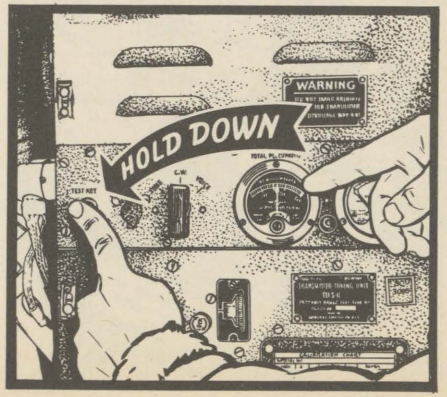
When the test key is depressed, if the plate current meter does not indicate voltage, one of the high voltage fuses in the plate circuit may be burned out. Turn the transmitter OFF and remove the tuning unit.

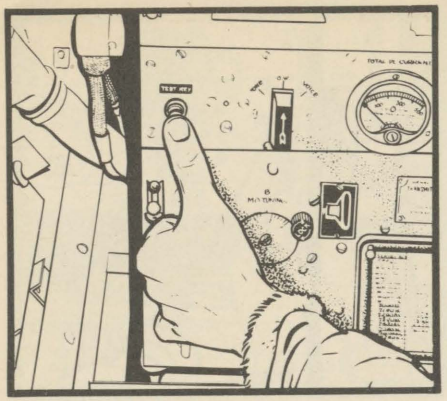


Remove the FUSE in the upper back portion of the TUNING UNIT COMPARTMENT and install one of the SPARE FUSES which are mounted on the inside of the TUNING UNIT frame. Replace the unit and lock the snap slides.

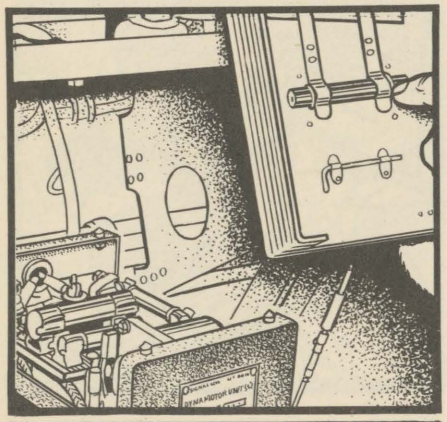


Turn the TRANSMITTER switch to the ON position.
Press and hold the TEST KEY down and turn dial C to obtain the minimum value of the plate current.

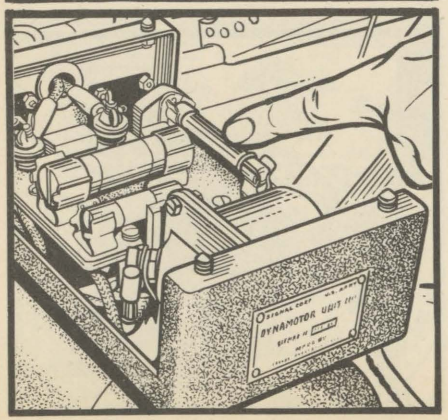


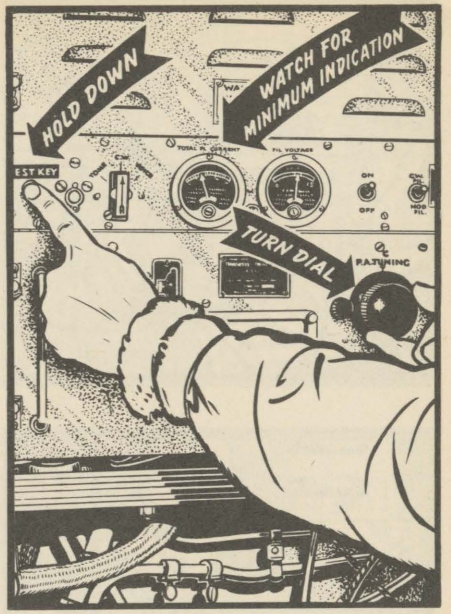


Turn ON the transmitter and again press the TEST KEY. If the plate current meter still does not indicate, turn the transmitter OFF and . . .



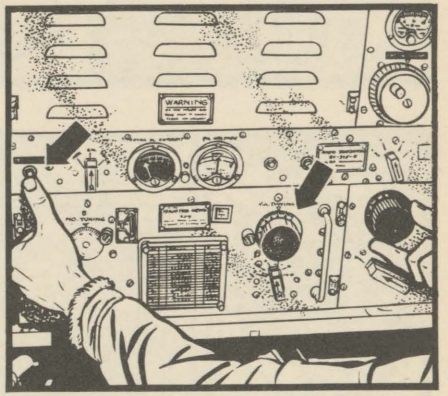
. . . remove the cover from the DYNAMOTOR. A spare high voltage fuse is clipped to the cover. Remove the fuse from the dynamotor and replace it with the spare. Replace and lock the cover. WARNING: Do NOT remove any transmitter or dynamotor shields when transmitter power is ON. High voltages will be exposed which may cause serious injury or death. Turn the transmitter ON and . . .

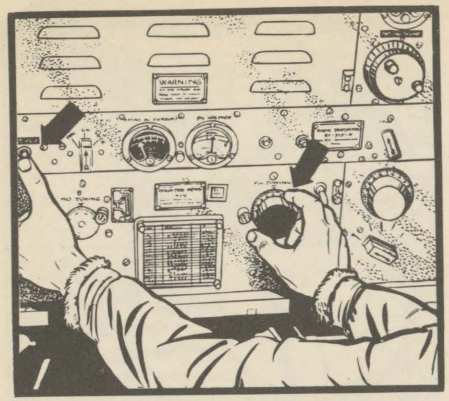




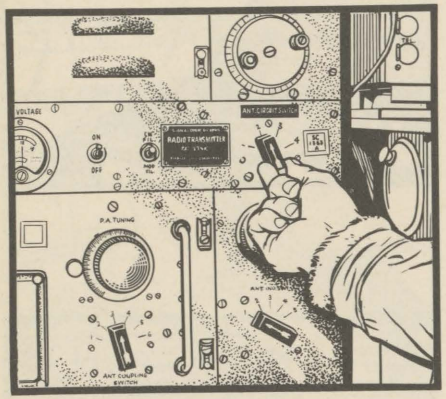
. . . again press the test key and turn dial C to obtain the minimum value of plate current and . . .

. . . turn ANT. IND. TUNING dial M to obtain the maximum value of plate current. NOTE: if there is no deflection of the plate current meter in the preceding step, or if the maximum plate current is less than 210 to 220 milliamperes, increase the ANT. COUPLING SWITCH D and repeat the above tuning operation. It may be necessary to change the position of the ANT. CAP. TUNING, control O, and repeat the tuning operations to obtain a satisfactory plate load of 210 to 220 milliamperes.
WARNING: When tuning the transmitter, be careful that the plate current meter does not reach full scale deflection.

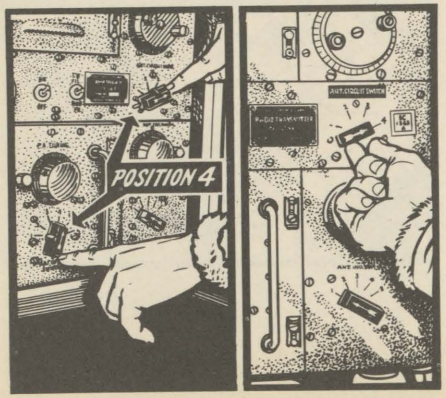




Move dial C to determine if a decrease in plate current can be produced. If the movement of dial C which produces the lowest value of plate current exceeds 2 to 3 dial divisions, or if the decrease in plate current exceeds 5 to 10 milliamperes, tuning operations should be repeated.

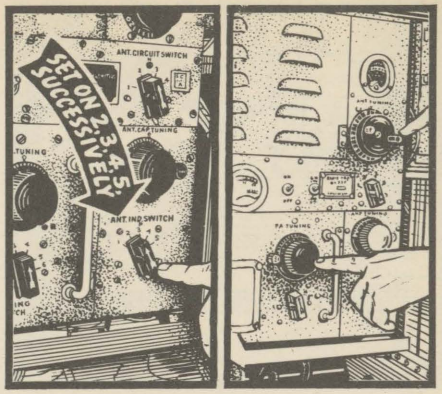


If the transmitter cannot be properly tuned with the ANT. CIRCUIT SWITCH N on position 2, place on position 1 or 3, and repeat the tuning procedure. On position 3 the ANT. CAP. TUNING control O will not be used.

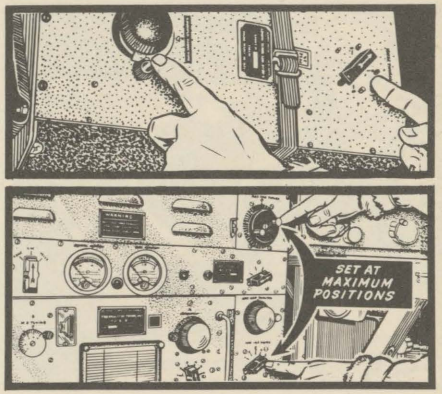


To operate the transmitter on frequencies covered by TUNING UNIT TU-26-(B), tune as directed in the preceding operating instructions, except that ANT. COUPLING SWITCH D and ANT. CIRCUIT SWITCH N should be placed on position 4.

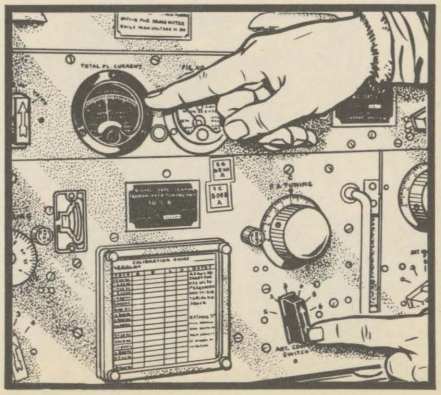
If it is not possible to tune the transmitter, set the ANT. IND. SWITCH P successively on position 2, 3, 4, and 5, and retune the transmitter on each position by turning dials C and M.

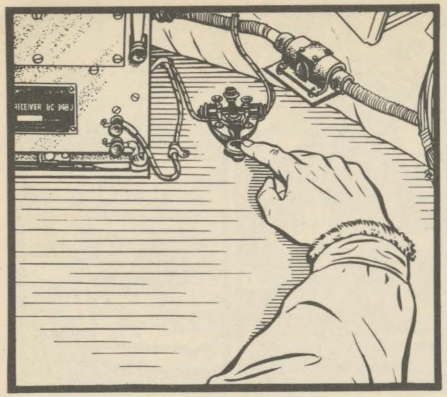


If the transmitter still is not tuned, set the ANT. IND. TUNING dial M and the ANT. IND. SWITCH P to their maximum position, set the ANTENNA VARIOMETER SWITCH E successively on positions 2, 3, 4, and 5 and attempt to tune the transmitter by tuning the ANTENNA VARIOMETER SWITCH F for maximum plate current. Again use dial C to get a minimum reading on the plate current indicator until a further increase in plate current by use of dial F can no longer be decreased by use of dial C.

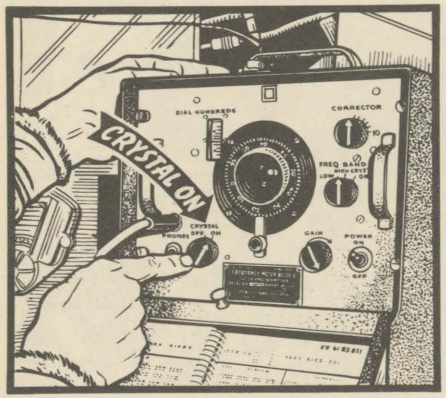


If the transmitter is tuned, adjust the ANT. COUPLING SWITCH D so that the plate current meter does not indicate above 210 to 220 milliamperes.

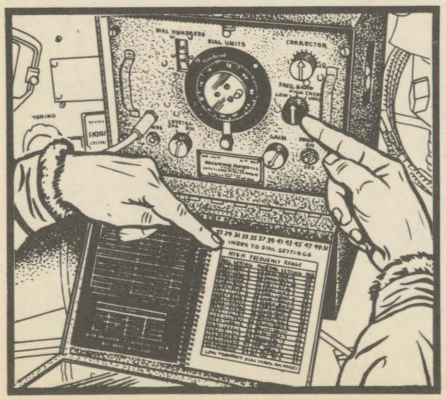




Transmission on CW now may be accomplished by use of the HAND KEY.

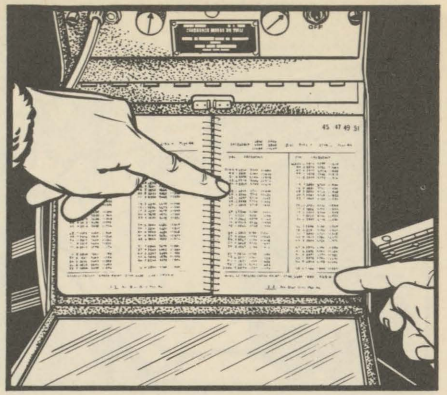


To check the transmitting frequency with the frequency meter, adjust the meter by securing an antenna (not over two feet long) to the antenna terminal on top of the frequency meter cabinet. Turn the CRYSTAL SWITCH to the ON position.

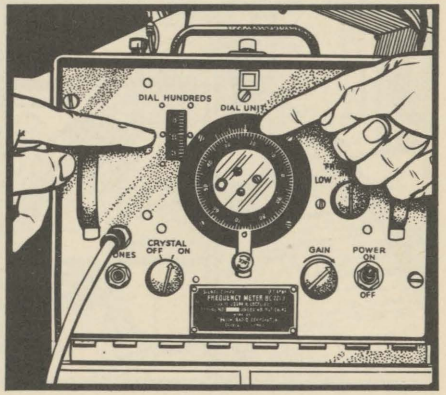


From HIGH or LOW frequency indices on the front or rear cover of the calibration book, determine in which band the desired frequency is located. Set the FREQ. BAND selector switch to correspond.

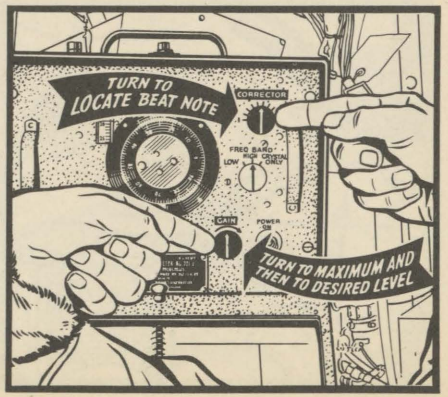
Locate the desired frequency in the calibration book. NOTE: The desired frequency in this example is 2855 Kc. The CRYSTAL CHECK POINT and the HETERODYNE TUNING DIAL setting are at the bottom of the page. NOTE: In this example the setting is 1923.0.

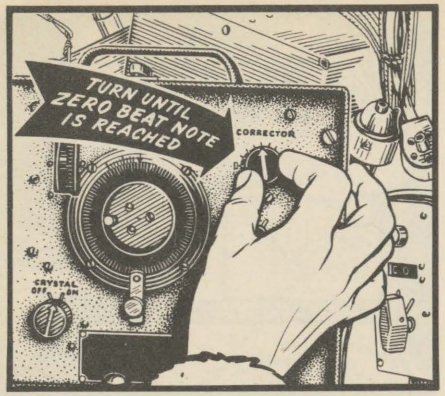


Unlock and set the HETERODYNE TUNING DIAL to 1923.0. Relock the dial. NOTE: To obtain the DIAL SETTING for a frequency which falls between two listed frequencies, interpolate as directed in LIAISON TRANSMITTER operation.

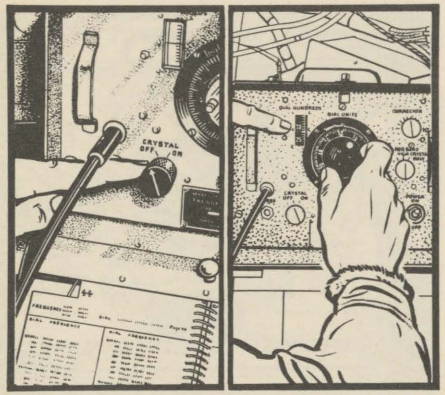


Put on the frequency meter headset and turn the GAIN control to its maximum position. Turn the CORRECTOR dial to the point where the BEAT NOTE can be heard. Adjust the GAIN control for the desired audio level.

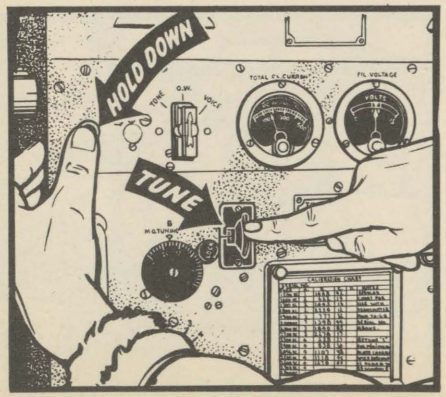




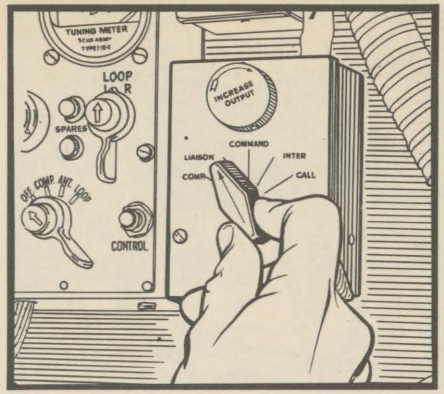
Adjust the HETERODYNE OSCILLATOR FREQUENCY by turning the CORRECTOR dial until a ZERO BEAT NOTE is reached.



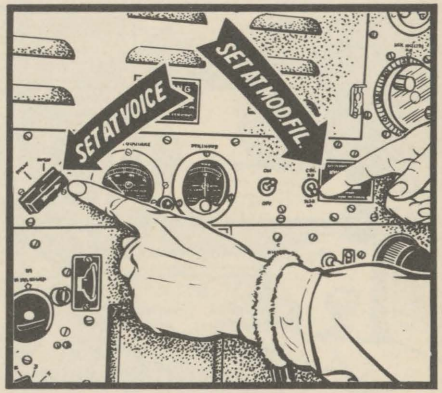
Set the CRYSTAL switch to the OFF position and reset the HETERODYNE TUNING DIAL to 2158.1 as indicated on the calibration chart and lock tuning dial. NOTE: Do not change the CORRECTOR adjustment.



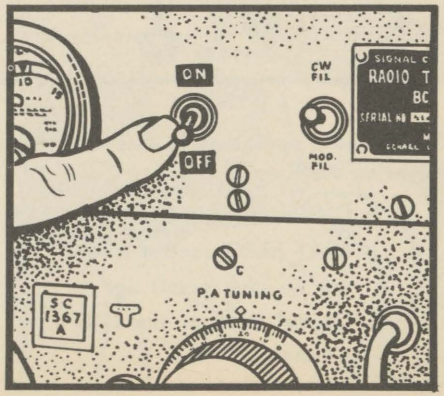
Press the TEST KEY on the transmitter. Vary dial B until a zero beat note is heard in the frequency meter headset and then adjust dial C to obtain a minimum dip on the plate current meter. If the BEAT NOTE drifts, repeat this procedure. Tighten all tuning control locks.



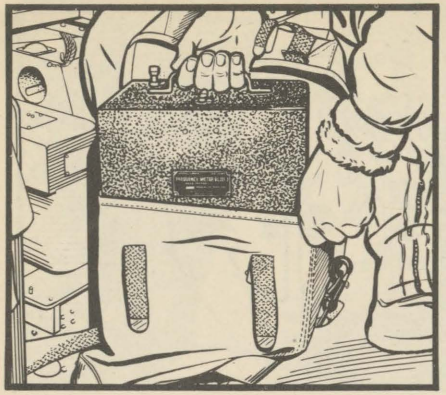
The transmitter is now adjusted for CW operation. Place the JACKBOX SELECTOR switch to the LIAISON position.



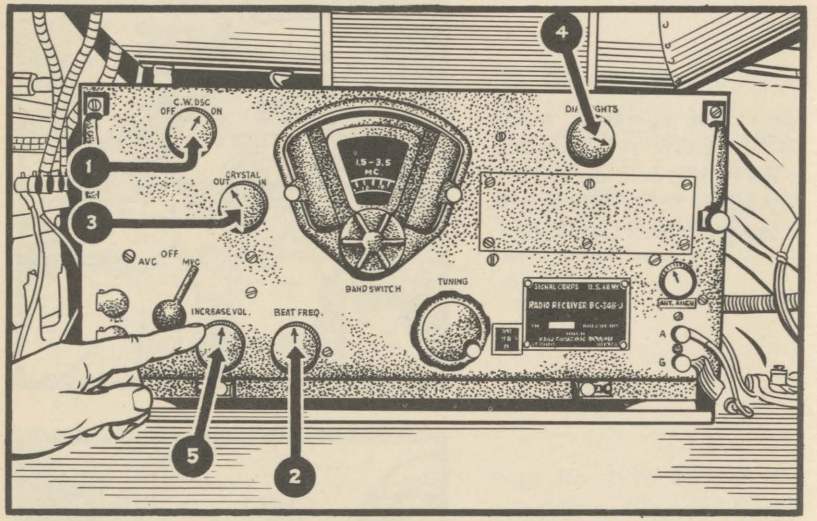
For VOICE operation, place the TONE-CW VOICE switch to the VOICE position, and the FILAMENT SELECTOR switch to the MOD FIL POSITION.



When the LIAISON TRANSMITTER is not in use, turn it to the OFF position.



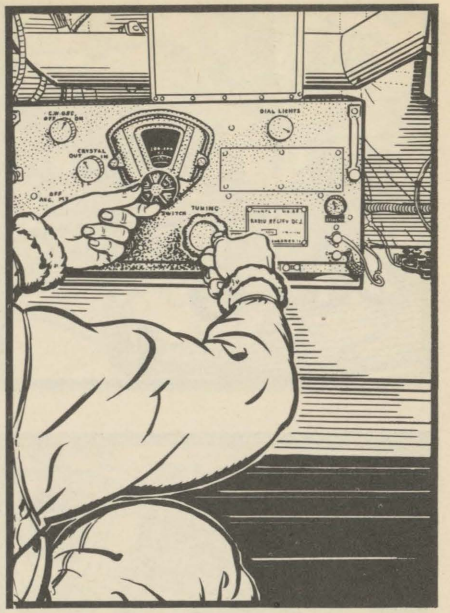
Turn the frequency meter to the OFF position, remove the headset, and replace the meter in its stowage position.



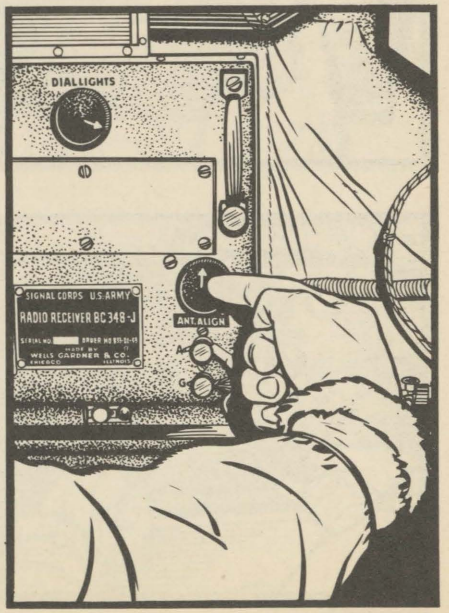
Put on radio operator's headset and set the controls on the receiver to the following positions:

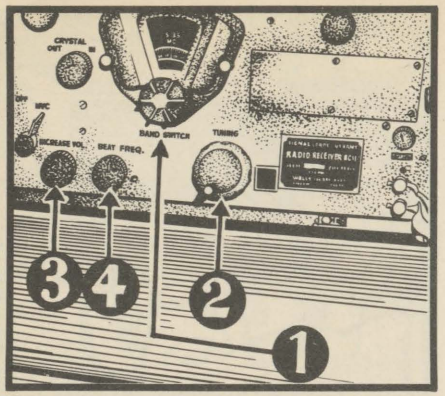
1. CW oscillator switch ON.
2. BEAT FREQ. control so arrow on knob points up.
3. Crystal knob at the OUT position.
4. Dial lights knob turned fully clockwise.
5. Turn INCREASE VOL. control clockwise until sufficiently strong background is heard.

Set the BAND CHANGE knob to the 200 to 500 Kc. band. Tune the receiver to the 500 Kc. or to the nearest signal by means of the TUNING knob. NOTE: If no signal can be received, use the BACKGROUND NOISE to make the following adjustment:

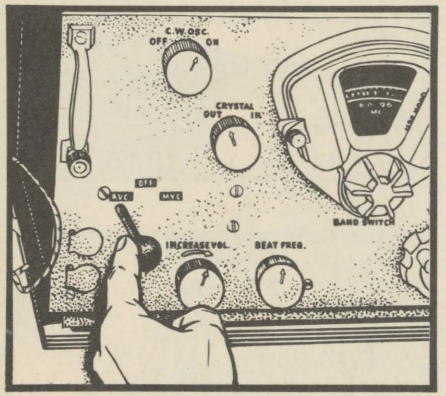


Turn the ANT. ALIGN control for maximum signal indicated by headset volume. The set is now ready to be operated at its maximum efficiency. NOTE: Some receivers do not have an antenna alignment control. In such cases this step is not required.

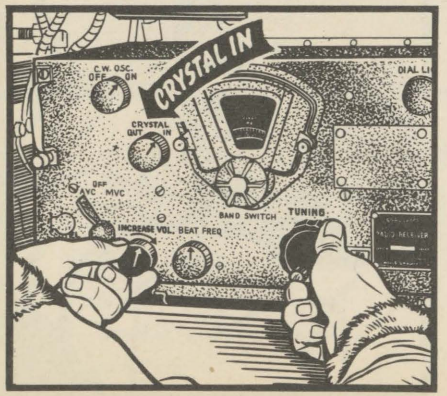




Tune in the desired signal by means of (1) BAND CHANGE switch, (2) TUNING crank and (3) VOLUME control. The signal pitch may be adjusted by turning (4) the BEAT FREQ. control knob for CW reception.

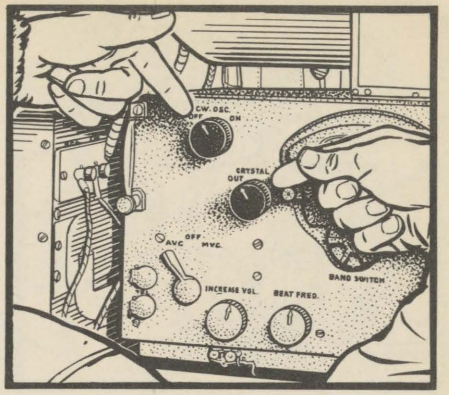


Automatic volume control may be employed after the signal is tuned in by setting the AVC-OFF-MVC switch to the AVC position.

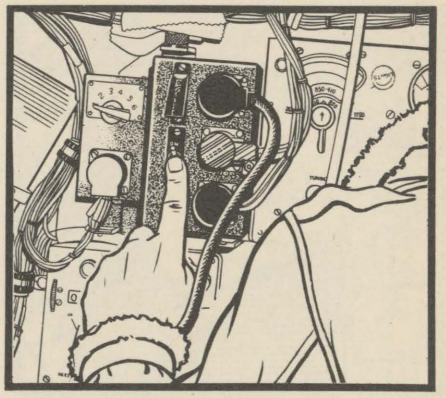


To eliminate noise and reduce interfering signals, turn the CRYSTAL switch to the IN position and make the necessary tuning adjustments.

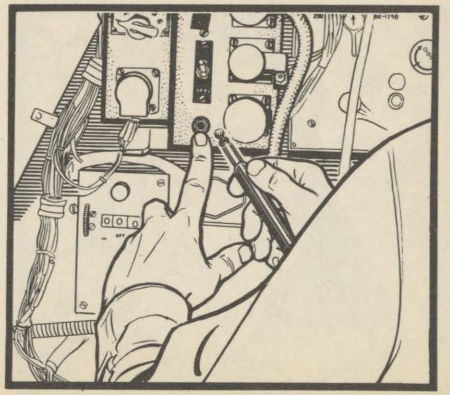
For voice operation, turn the CW OSC switch to the OFF position and the CRYSTAL switch to the OUT position.

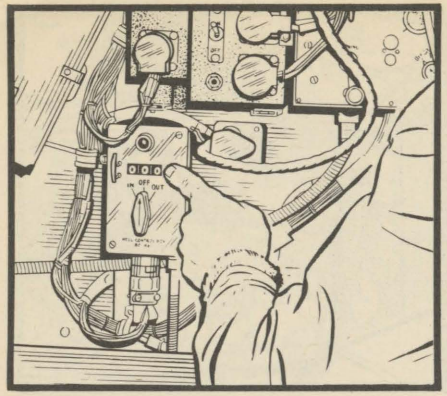


If the receiving station is in the vicinity, turn the IFF RADIO ON before take-off.

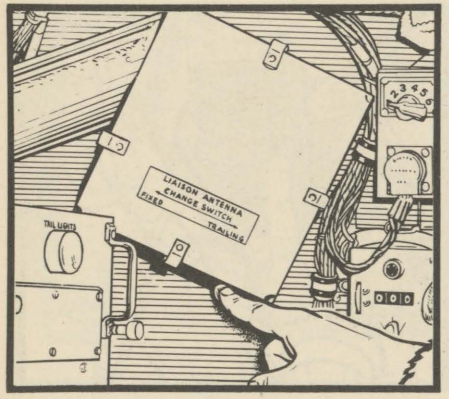


Plug the headset disconnector cord into the JACK on the IFF control box and listen for a characteristic tone.

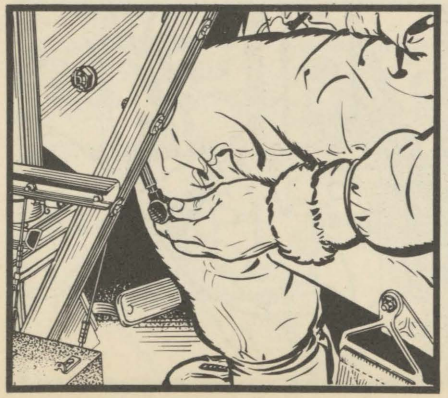




When it is desired to use the TRAILING ANTENNA, set the counter on the TRAILING ANTENNA CONTROL BOX to zero. (The counter registers in feet). WARNING: The trailing antenna will not be used when the airplane is flying in formation.

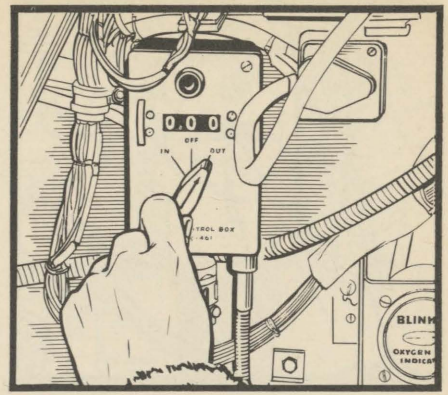


Place the LIAISON ANTENNA CHANGE SWITCH handle in the TRAILING position.

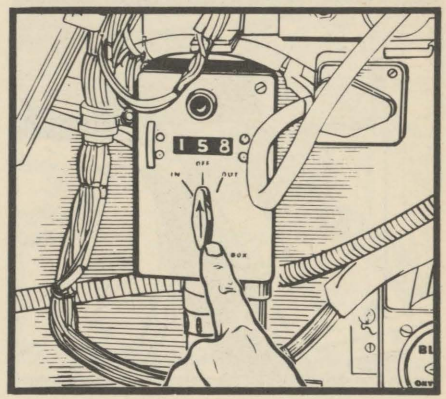


Open the trailing antenna door by pushing down and in on the knob and moving the handle downward to its lowest position. The handle will automatically lock in the OPEN position.

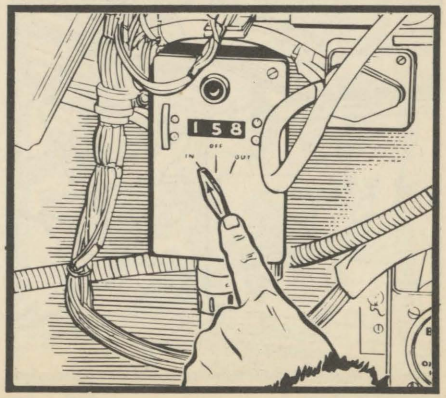
Set the switch handle to OUT on the TRAILING ANTENNA CONTROL BOX and . . .

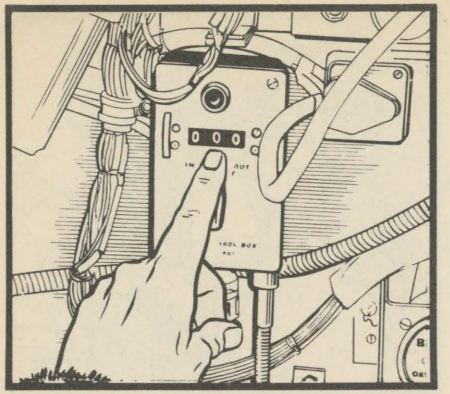


. . . extend the antenna not more than 200 feet. When the desired length of the antenna is extended, turn the switch to the OFF position.

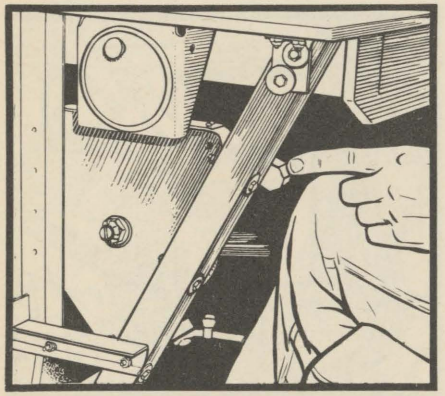


To retract the TRAILING ANTENNA, set the control switch to the IN position.

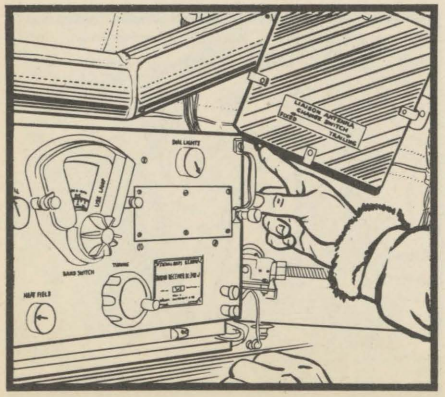




When the antenna wire is all wound in, the counter will stop rotating. Turn the switch to the OFF position and zero the counter if necessary.

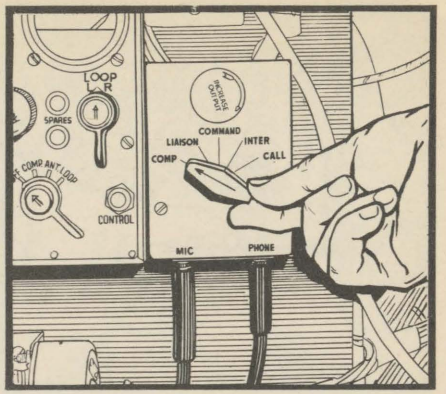


Close the TRAILING ANTENNA door. The handle will automatically lock in the CLOSED position.

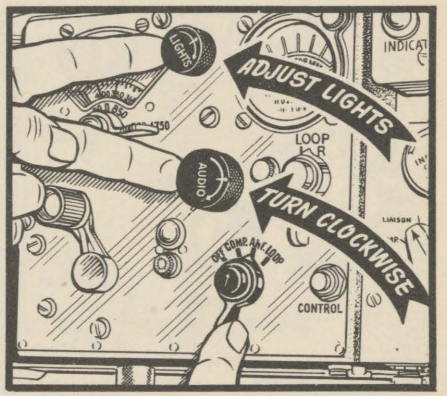


Place the LIAISON ANTENNA CHANGE SWITCH handle to the FIXED position.

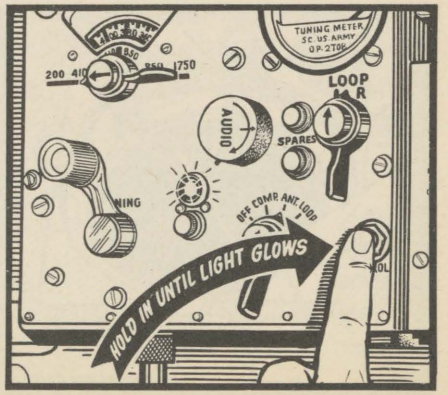
To use the RADIO COMPASS, set the JACKBOX SELECTOR switch to COMP. and . . .

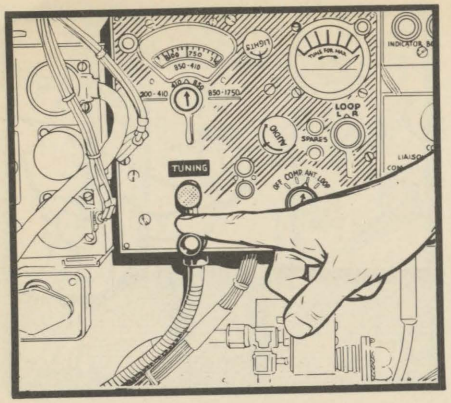


. . . turn the compass on by placing the selector switch to the ANT. position. Turn the AUDIO control clockwise and regulate the light by adjusting the LIGHTS knob.

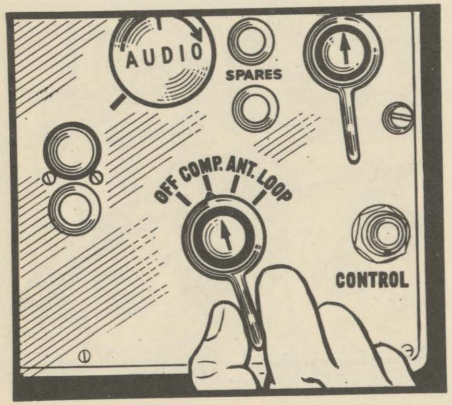


Push the CONTROL switch IN until the green control light comes on.

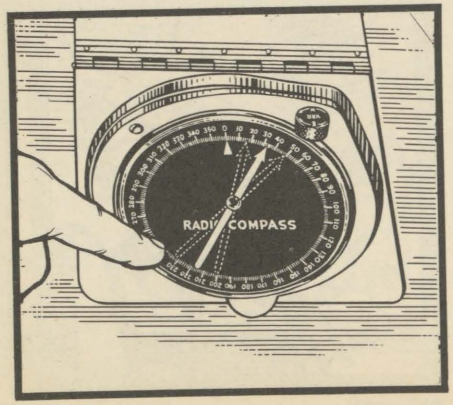




Tune to the desired station until a maximum signal is indicated on the TUNE FOR MAX. meter.

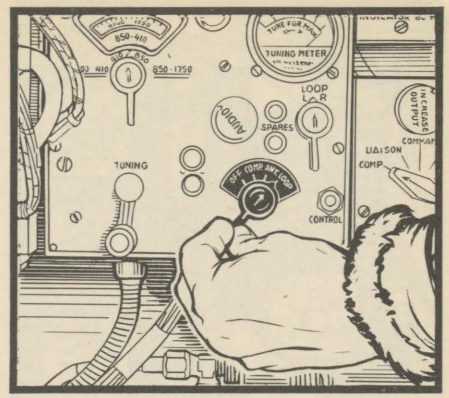


Change the selector switch to the COMP. position and . . .

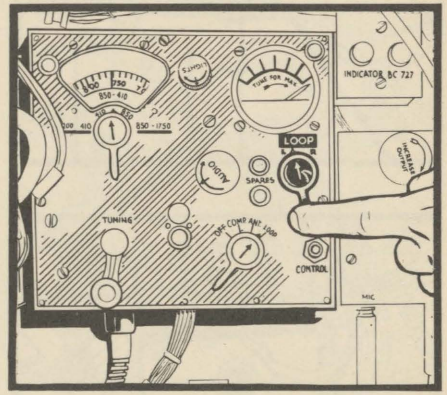


. . . observe the indicator needle "hunting" the signal which is coming into the receiver.

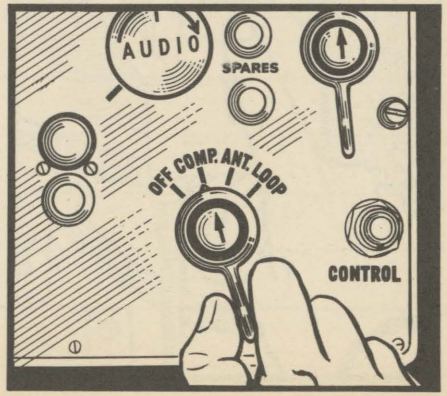
When the needle stops on a definite reading, set the selector switch to the LOOP position.



Turn the indicator away from the original reading (left or right) and . . . .

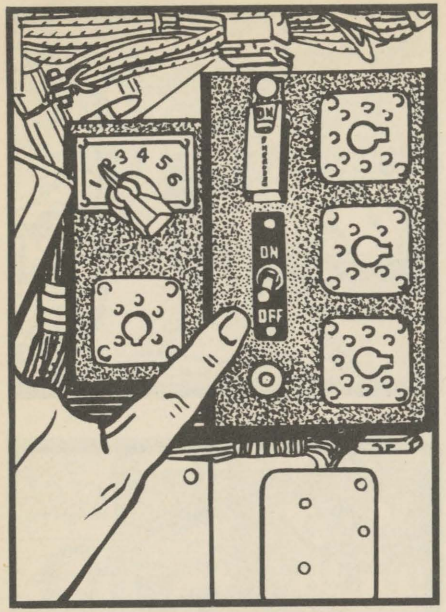


. . . . set the selector switch back to the COMP. position. The radio compass is functioning properly when the needle returns to its original position.

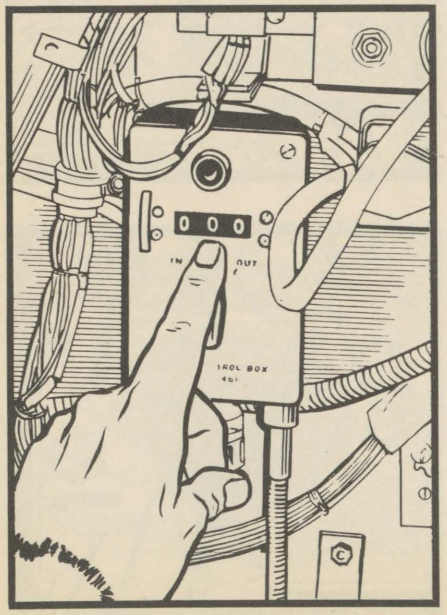


BEFORE LANDING

RADIO OPERATOR



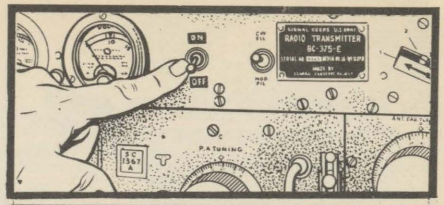
Before landing, the IFF equipment MUST BE TURNED OFF.



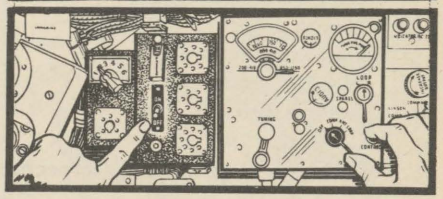
Be sure that the trailing antenna is reeled in.

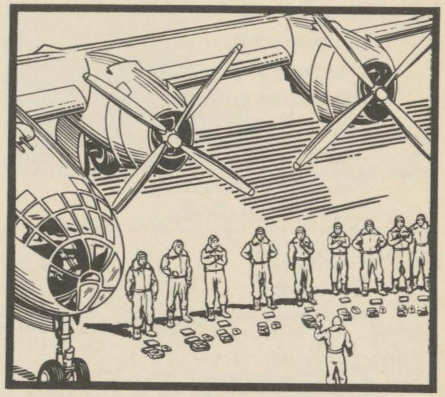
AFTER LANDING

RADIO OPERATOR



Turn all radio equipment OFF.





When instructed by the pilot, leave the airplane and join the formation for inspection by the pilot. Give the flight engineer reports on faulty equipment.

NOTES:

NAVIGATOR'S CHECK LIST

BEFORE ENTERING THE AIRPLANE
- Batteries and bulbs for sextant.
- Navigation kit.
- Daily check list.
- Mission data.
- Pre-computation.
- Weather conditions.
- Correct time.
- Clothes.
- Personal effects for pilot's inspection.

DURING ENGINE STARTING AND WARM-UP
- Parachute.
- Life preserver.
- Oxygen equipment.
- Navigation equipment.
- Time.
- Altimeter.
- Flux gate compass gyro.
- Compass sensitivity.

BEFORE TAKE-OFF
- Equipment.
- Flux gate compass gyro.

DURING FLIGHT
- Continual navigation procedure.
- Set fire control unit for:
  - Temperature.
  - Altitude.
  - Airspeed.

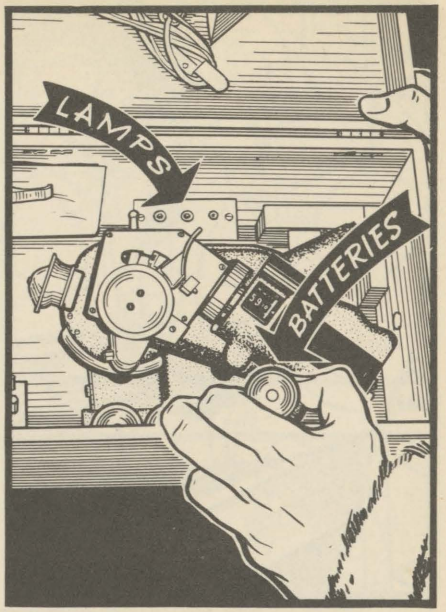
BEFORE LANDING
- Equipment.
- Driftmeter shield.
- Flux gate compass gyro.

AFTER LANDING
- All switches.
- Reports.

BEFORE ENTERING THE AIRPLANE

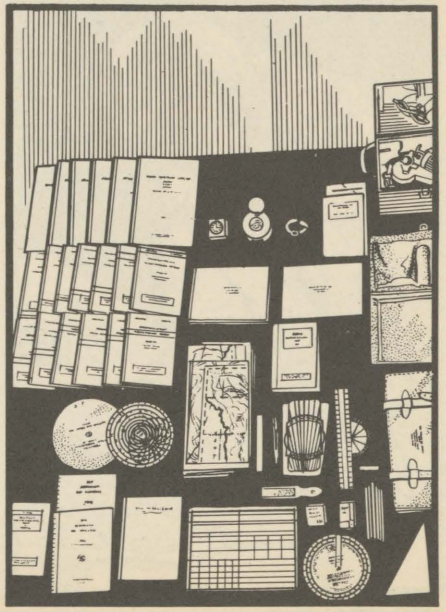
NAVIGATOR

Check the sextant case for fresh batteries and lamps.



Check the contents of the navigation kit for the following:

- E-6-B computer.
- TAS computer.
- Divider and compass.
- Weems plotter.
- Sharp pencils.
- Paper clips.
- Thumb tacks.
- Erasers.
- Insert.
- Triangles.
- H.O. 218 for general area of flight.
- H.O. 211.
- Watches, Type A-8, A-11, and A-13.
- Navigator's logs.
- H.O. 214 or 218 forms.
- H.O. 211 solution forms.
- Plotting charts within operational limits.
- Current air almanac.
- Rude star finder.
- Great circle solution forms.
- Pilotage charts within operational limits.





Look over each item on the daily check list. Be sure that the list was properly completed.

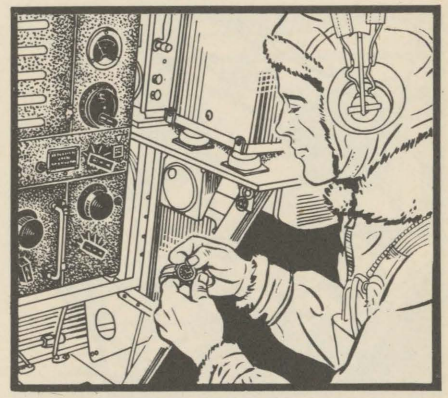


Know the exact destination, departure point, and purpose of the mission. Familiarize yourself with the danger areas likely to be encountered. Pre-computations should include the distances and courses of legs on the mission, the approximate time required, fuel consumption and running curves.

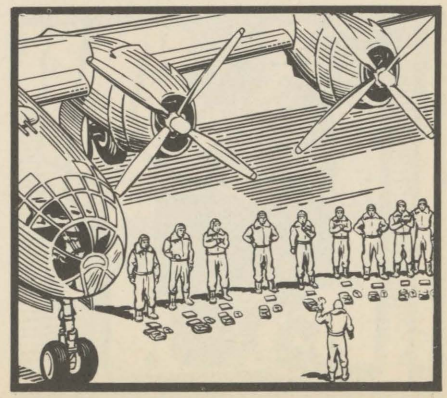
Weather conditions should include present weather, forecast for period of time and area of the flight, altimeter settings and available winds.

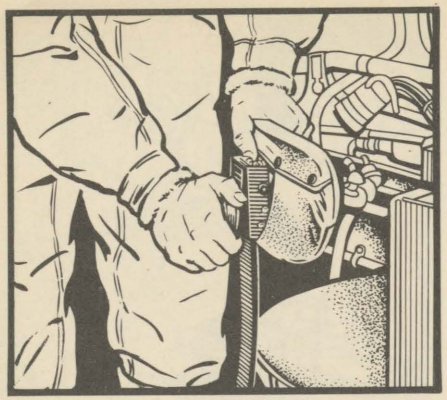


Synchronize all watches with the time at the radio tower. (This may be done after briefing.) A four second error at 20,000 feet will result in an error of approximately one mile in the course.

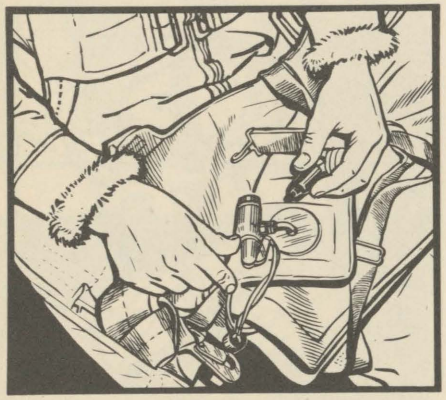


Prepare your personal effects for inspection by the pilot before entering the airplane. See that adequate clothing for the mission to be performed is available.

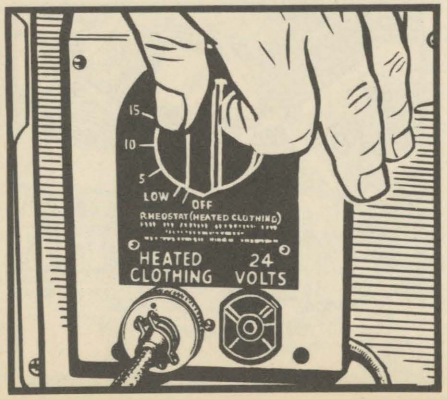




Enter the airplane. Adjust the seat at your station. Stow all equipment. Do not wear your parachute until the airplane is ready to take off.

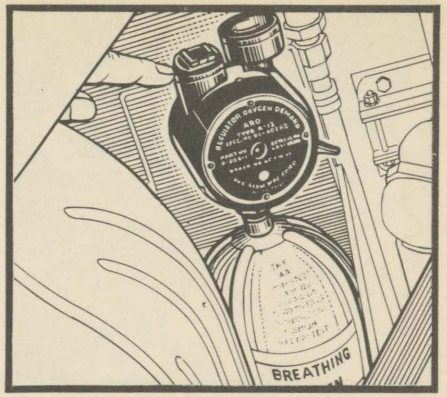


Check the condition of your LIFE PRESERVER and CO_2 CYLINDER. See that the CO_2 cylinder is not punctured and that the puncturing arm is safetied.

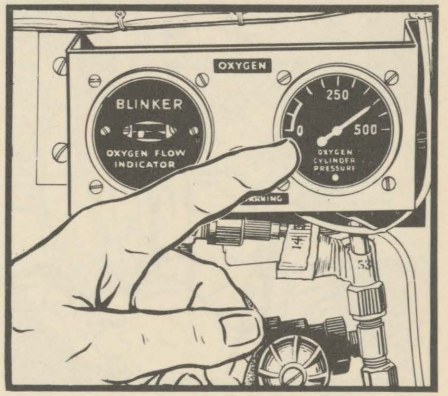


Plug in the connector of your HEATED FLYING SUIT. Be sure that the rheostat is in the OFF position. Try the various circuits. Be sure that each circuit operates properly and that the elements in your suit supply heat.

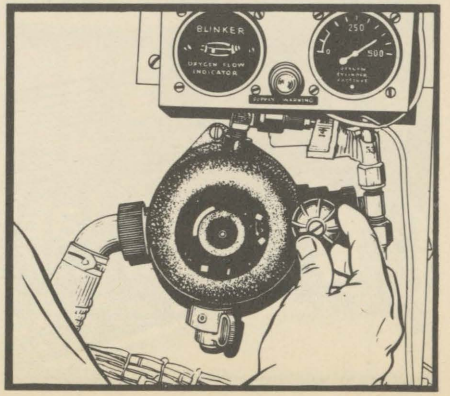
See that a fully charged PORTABLE OXYGEN BOTTLE is within easy reach.



The OXYGEN SUPPLY PRESSURE should read 400 to 425 pounds per square inch.



Check the operation of the OXYGEN FLOW INDICATOR. Turn the emergency valves ON. The flow indicator will stay open.

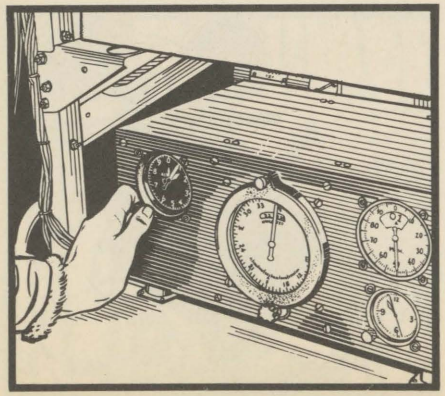




Arrange the navigation equipment for use during flight. Be sure that the sextant is stowed securely.

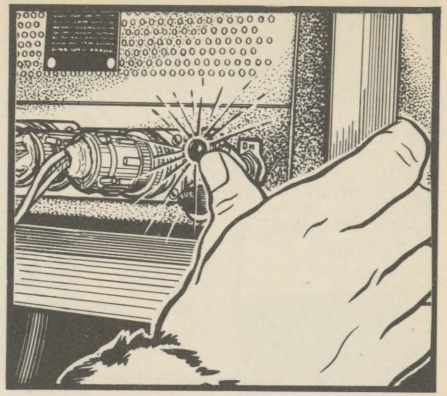


Advise the crew members over the interphone to synchronize all watches with your timepiece.

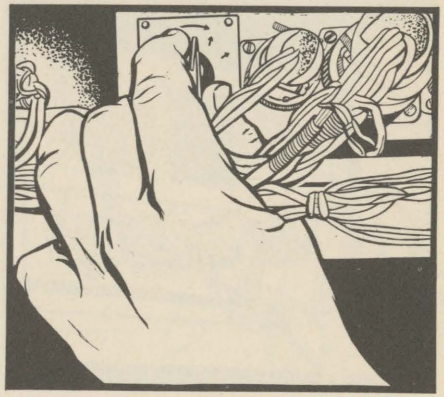


Set the PRESSURE ALTITUDE on the ALTIMETER.

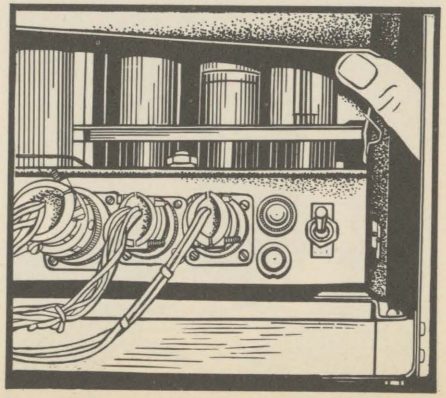
Turn the FLUX-GATE COMPASS amplifier switch to the ON position. (The green indicator light should glow.) This energizes the GYRO MOTOR, AMPLIFIER, and the TRANSMITTER.

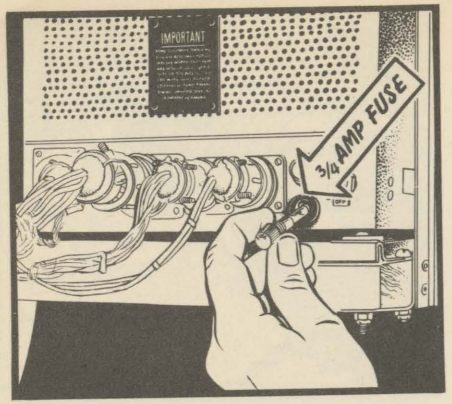


Check the COMPASS sensitivity.

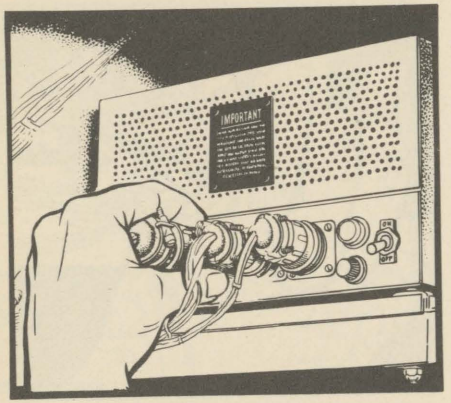


Lift the cover of the AMPLIFIER and visually check the TUBES for glow.

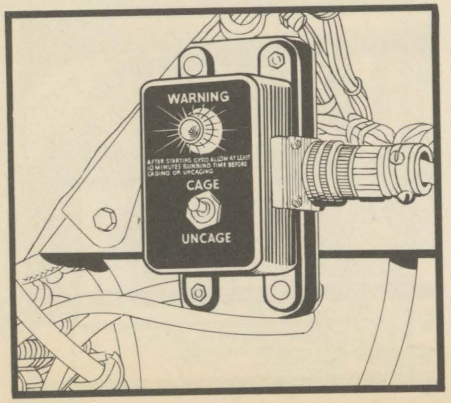




If the tubes are not working, check the 3/4 ampere FUSE. Replace the fuse or tube if necessary.

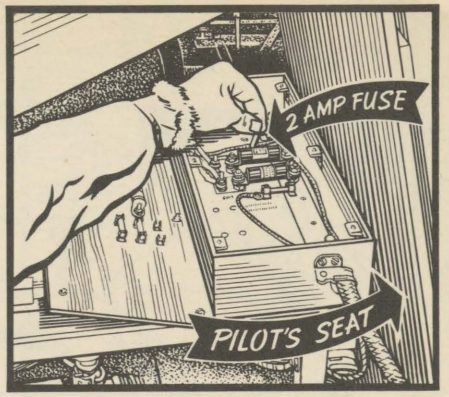


Check the security of all the CANNON PLUGS.

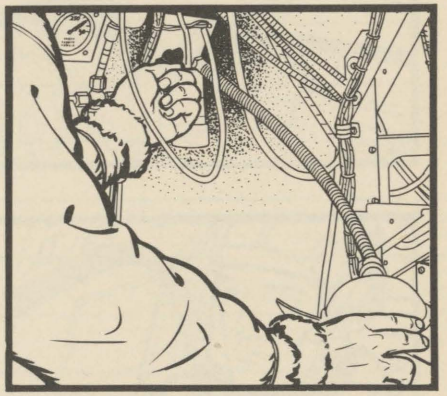


Check the GYRO CAGING switch box. The red light should be ON and the switch turned to the CAGE position. CAUTION: Permit the gyro to run for at least ten minutes before uncaging it. All gyro instruments must be uncaged at landing and caged at take-off.

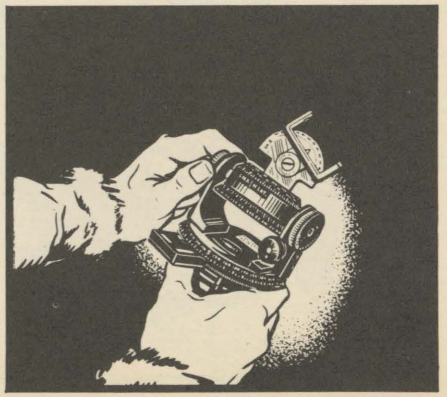
Check the 2 ampere FUSE for the electric caging switch. This fuse is located in a box at the rear of the pilot's seat.



Check all LIGHTS at your station.

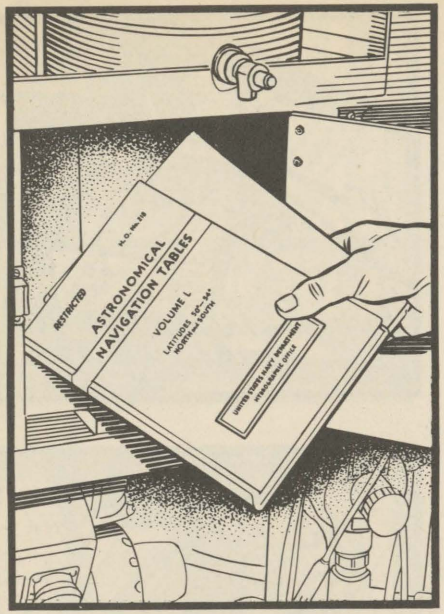


See that the ASTRO-COMPASS is aboard the airplane. Turn the knobs to see that all moving parts operate properly.



BEFORE TAKE-OFF

NAVIGATOR



Make sure that all of your equipment is secure.



Hold the SEXTANT in your lap during the take-off.

DURING FLIGHT

NAVIGATOR

Continue the navigation procedure.



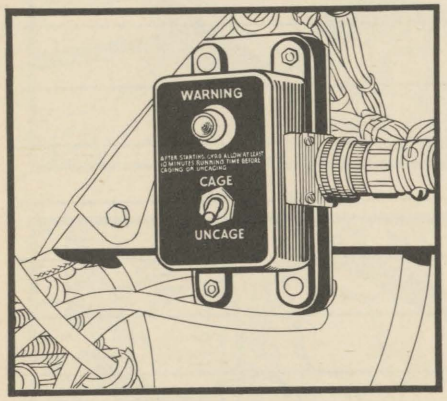
NOTES:

BEFORE LANDING

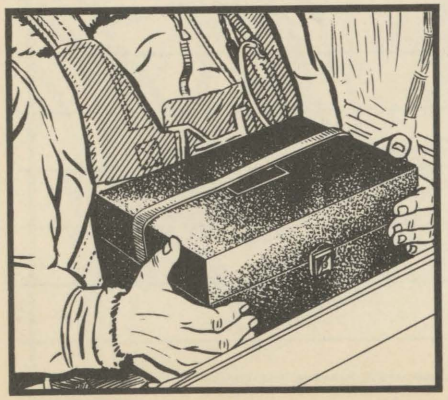
NAVIGATOR



Secure all navigation equipment.



Leave the COMPASS GYRO UNCAGED for the landing.

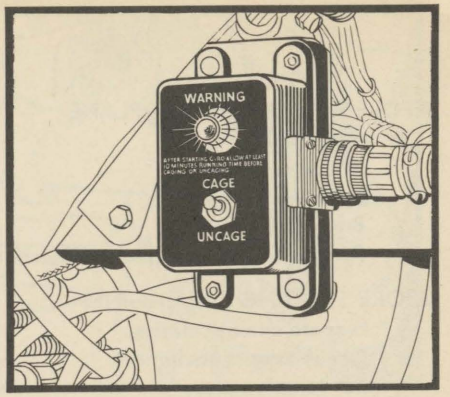


Hold the SEXTANT in your lap during the approach to a landing.

AFTER LANDING

NAVIGATOR

Cage the GYRO COMPASS.



Make out your flight report. Turn all switches to the OFF positions.



Leave the airplane and join the formation for inspection by the pilot.



BOMBARDIER'S CHECK LIST

BEFORE ENTERING THE AIRPLANE
- Bomb sight.
- Windows.
- Bomb load.
- Brief case data.
- Personal effects for pilot's inspection.

BEFORE STARTING THE ENGINES
- Prepare combat station.
- Check oxygen equipment.
- Air temperature.
- Clock synchronization.
- Pressure altitude.

BEFORE TAKE-OFF
- Altimeter.
- Pre-flight bomb sight.
- PDI check.

DURING FLIGHT
- Observe.
- Altitude.
- Trail and disc speed.
- Dropping angle.

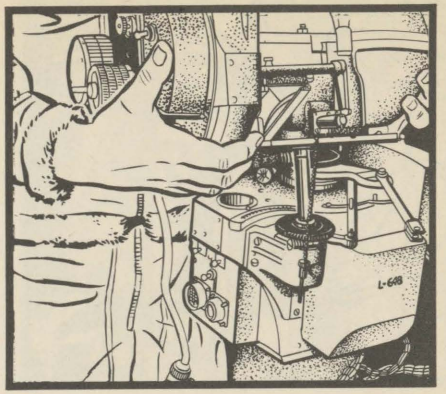
BEFORE LANDING
- Overnight setting on sight.
- Sight.
- Report.

AFTER LANDING
- Combat station.
- Malfunctioning of equipment.
- Reports.

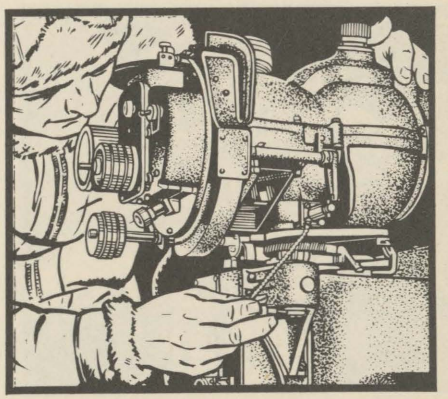
BEFORE ENTERING THE AIRPLANE

BOMBARDIER

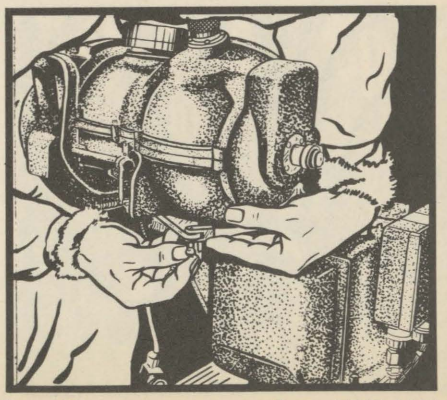
If the BOMB SIGHT is not in the airplane, install it with extreme care.

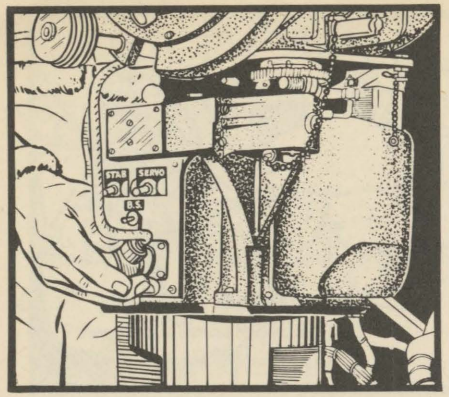


First, fasten the SIGHT STEM PIN, and . . .

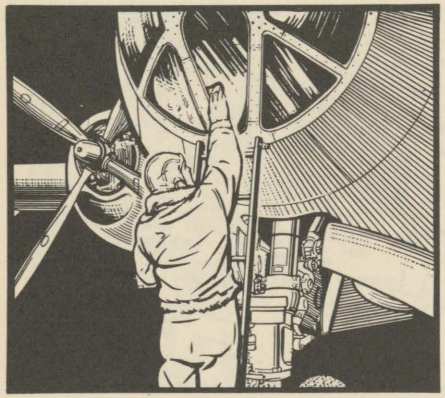


. . . the diagonal ARM PIN.

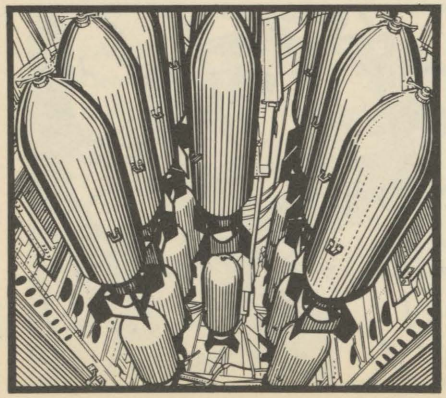




Fasten the CANNON PLUGS.

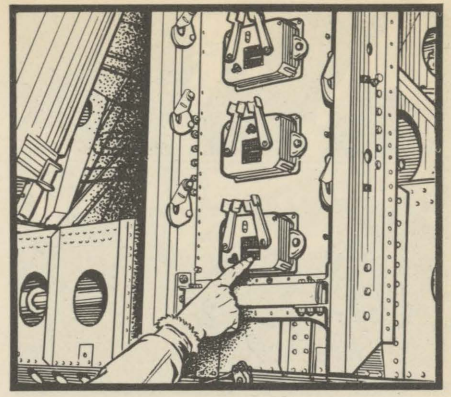


Leave the airplane and examine both sides of each WINDOW in your compartment for cleanliness.

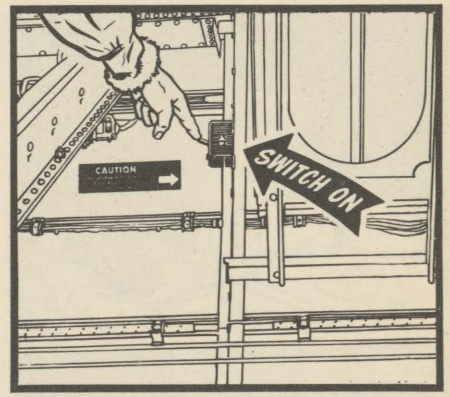


Check the BOMB LOAD. See that the proper type and size bombs have been loaded in their correct locations.

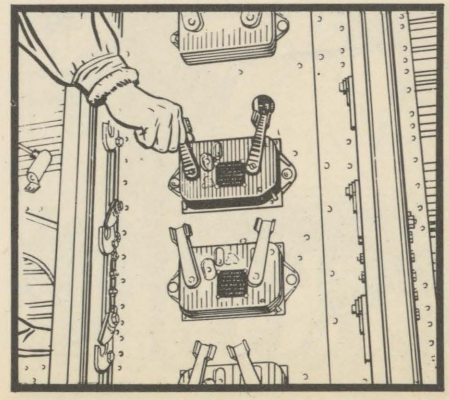
Inspect the UNLOADED bomb stations. Be sure the RELEASES at those stations are not cocked.



Make sure that the BOMB BAY TANK SAFETY switches are ON, so that an electrical impulse will open the releases.

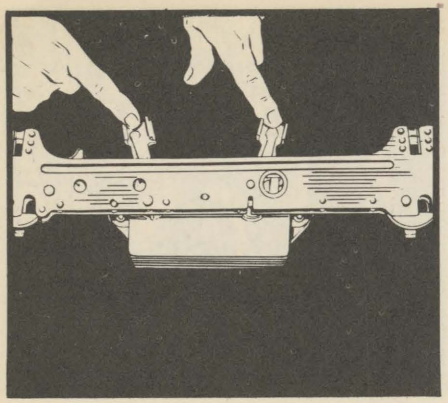


Inspect the RELEASES. See that they are securely fastened to the racks and . . .

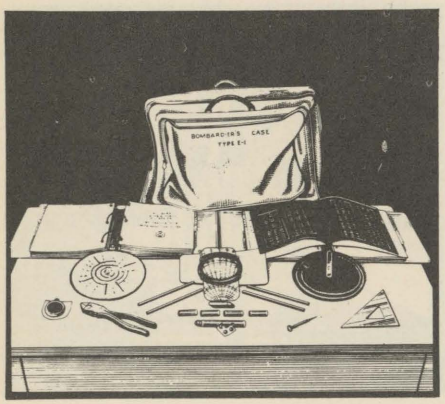


BEFORE ENTERING THE AIRPLANE

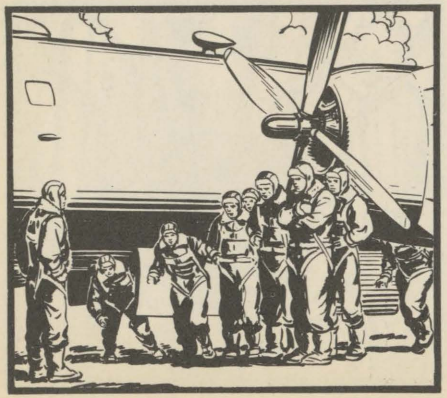
BOMBARDIER



. . . see that the RELEASE LEVERS are in place in the RELEASE ARMS.



Examine the contents of your kit. See that target and weather data, and all other information required for the mission is in the kit. See that the proper tables are included for the type bombs to be used on the mission.

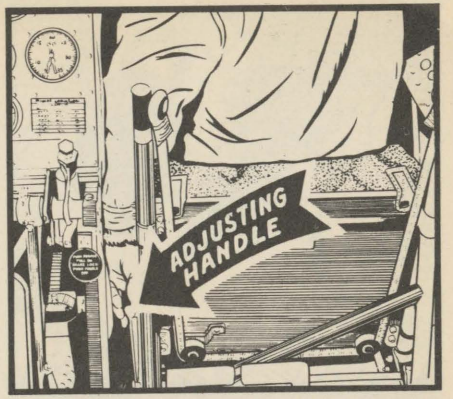


Prepare your personal effects for inspection by the pilot.

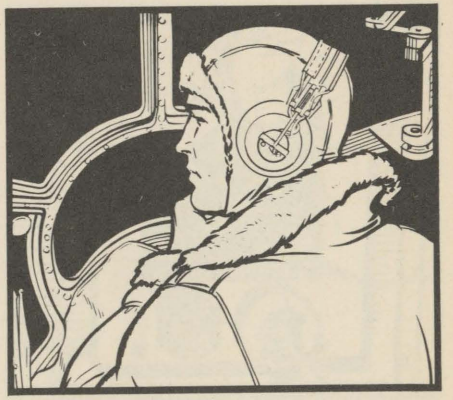
BEFORE STARTING THE ENGINES

BOMBARDIER

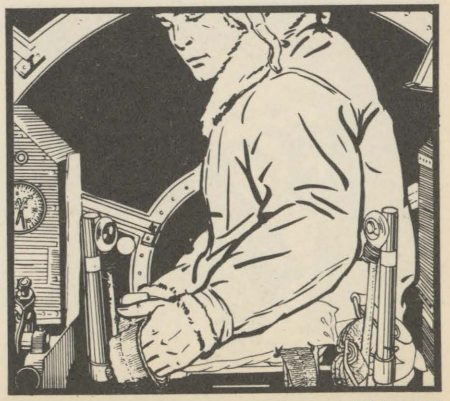
Enter the airplane and adjust your seat.

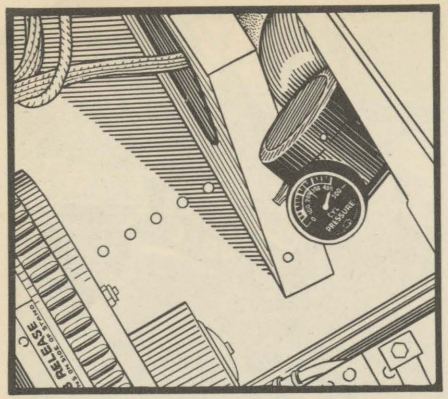


Adjust your EARPHONES and THROAT MICROPHONE.

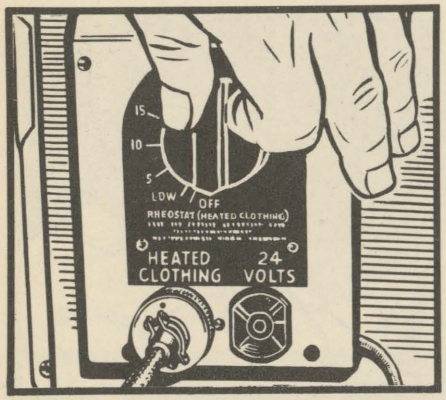


Place your PARACHUTE and OXYGEN MASK within easy reach.

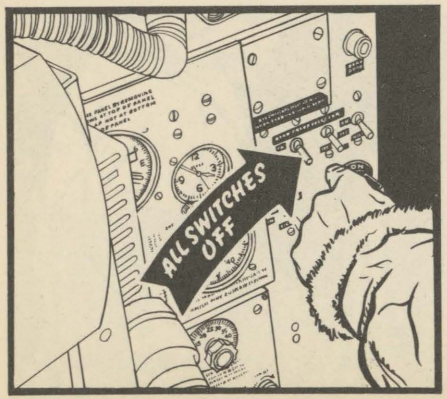




See that a fully charged PORTABLE OXYGEN BOTTLE is stowed in its proper location. Oxygen pressure should be 400 to 425 pounds per square inch.

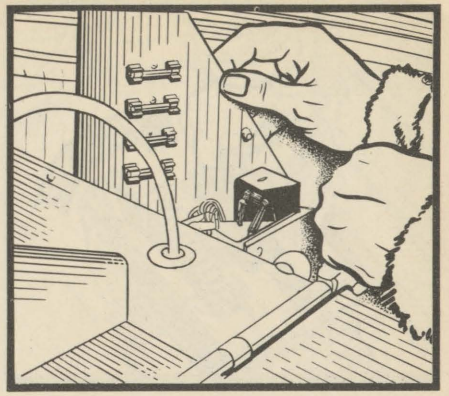


Plug in the connector of your HEATED FLYING SUIT. Be sure that the RHEOSTAT is in the OFF position. Try the various circuits. Be sure that each circuit operates properly and that the elements in your suit supply heat.

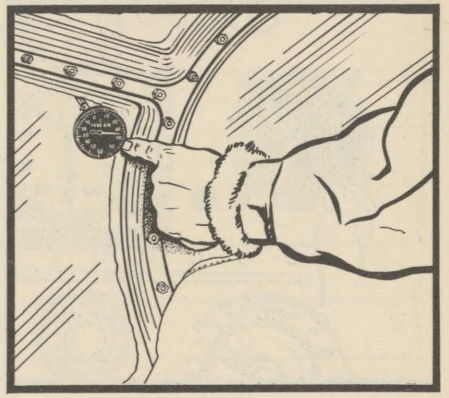


See that all switches on the bombardier's panel are in the OFF position.

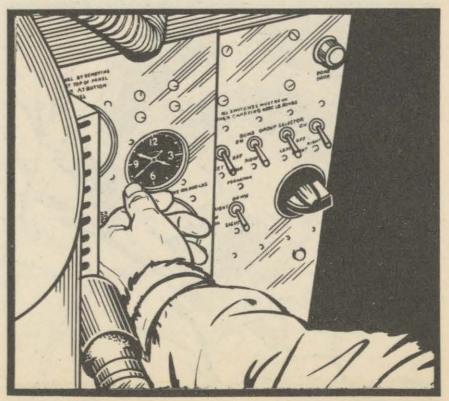
Check to make sure that extra fuses are available.

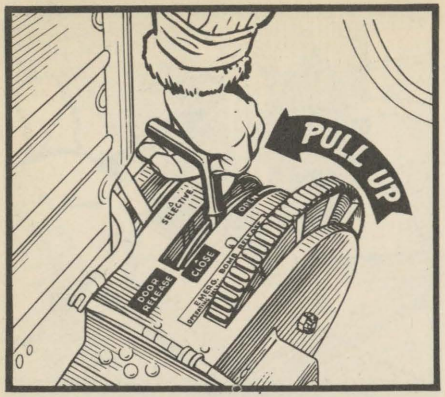


Note the AIR TEMPERATURE at ground level and compare its reading with the reading reported at 500 feet altitude.

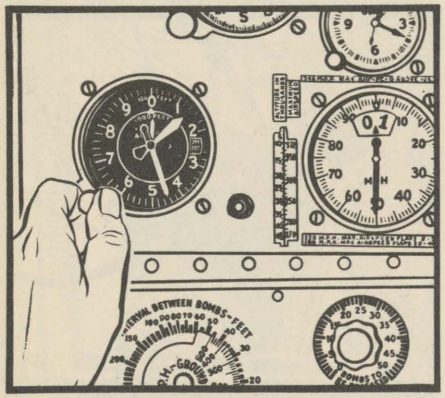


Synchronize your CLOCK with the navigator's watch.

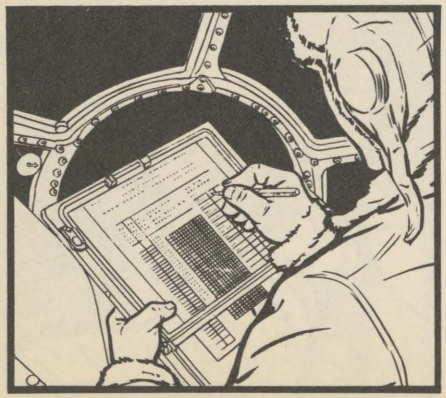




Be sure there are no obstructions under the airplane. At the command from the pilot, close the BOMB BAY DOORS.

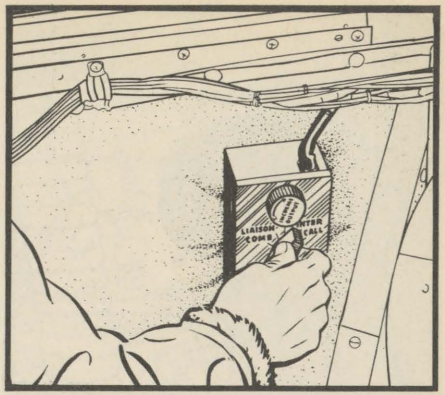


Obtain the PRESSURE ALTITUDE by setting the index marks on the ALTIMETER to zero.

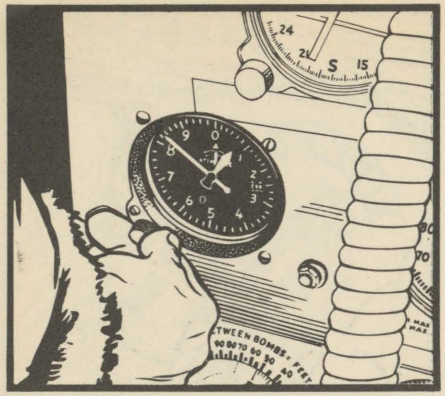


Record the altimeter reading on the proper form used for computing bombing altitude.

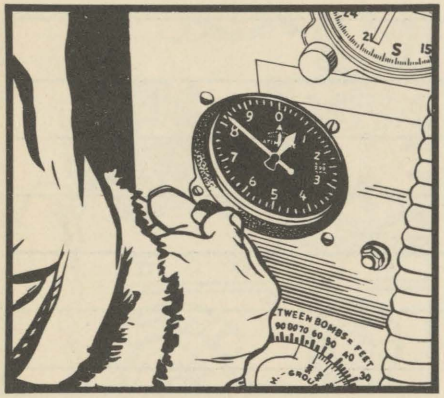
Turn the JACK BOX SELECTOR switch to INTER. (interphone) and respond to the co-pilot's call. Inform him of the status of the "Before Starting the Engines" section of the check list.



NOTES:



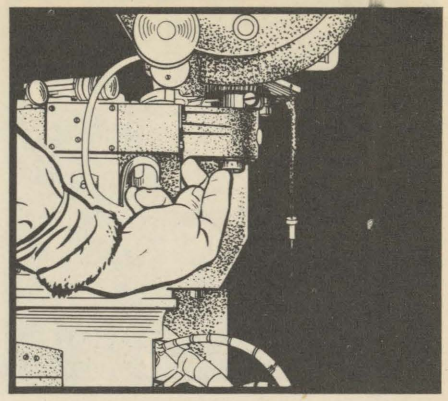
Set the altimeter to correspond to the altitude of the runway, or . . .



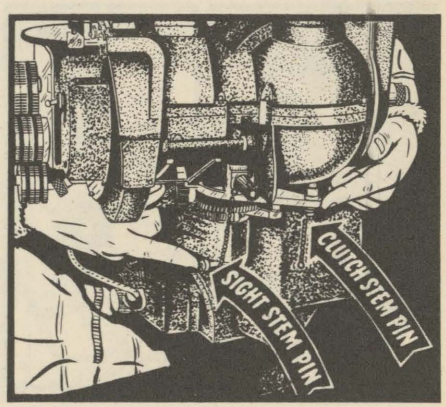
. . . set the altimeter to P.A. (pressure altitude) if so directed by the pilot.

NOTES:

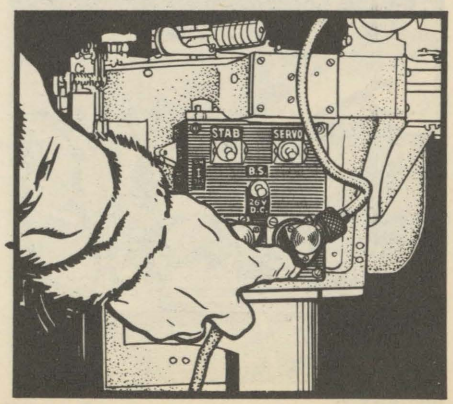
Check the dovetail alignment of the BOMB SIGHT.

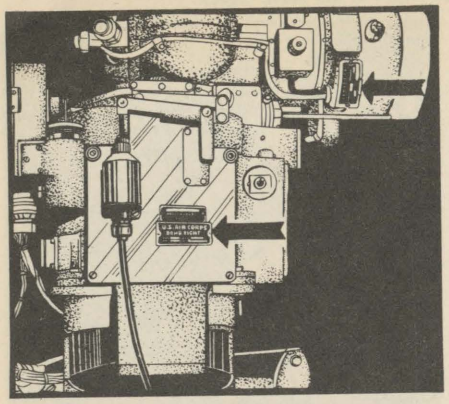


Check the LOCKING PINS:
(a) sight stem pin.
(b) clutch stem pin.

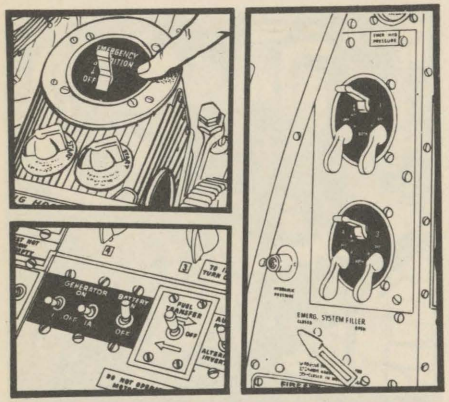


Be sure that the CANNON PLUGS are securely fastened in their sockets.

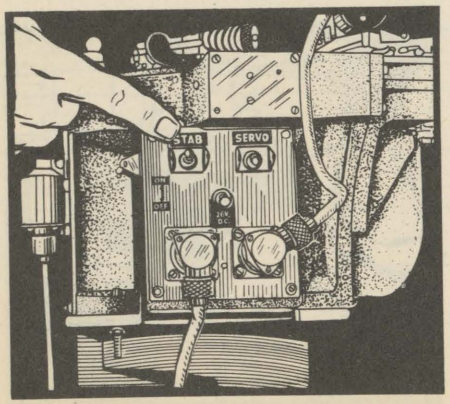




Check the serial number of the bomb sight STABILIZER and the serial number of the BOMB SIGHT.

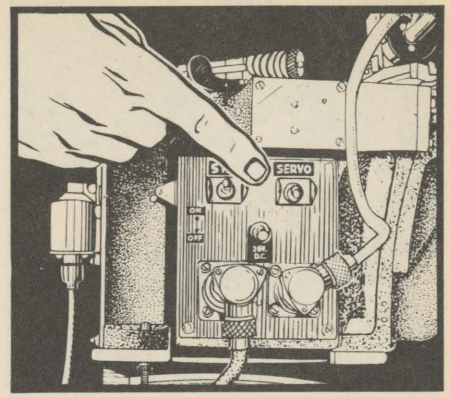


To see that the bomb circuits are in operation, make sure that the pilot's and flight engineer's master ignition switches are in the ON position.

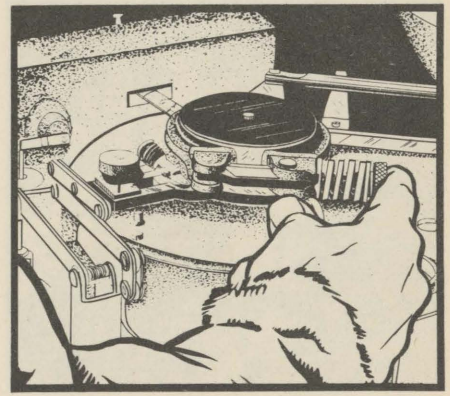


To avoid overloading the circuit, turn the DIRECTIONAL GYRO switch (STAB.) to the ON position. DO NOT TURN ON ANY OTHER SWITCHES FOR 3½ MINUTES.

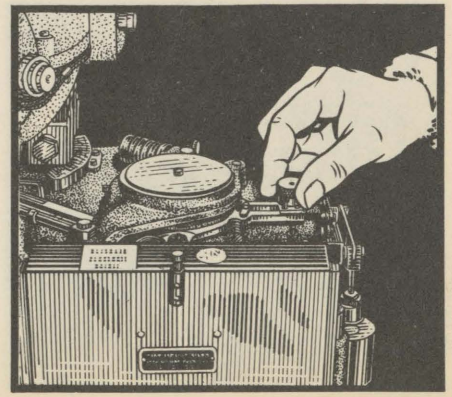
Turn the SERVO MOTOR switch to the ON position.

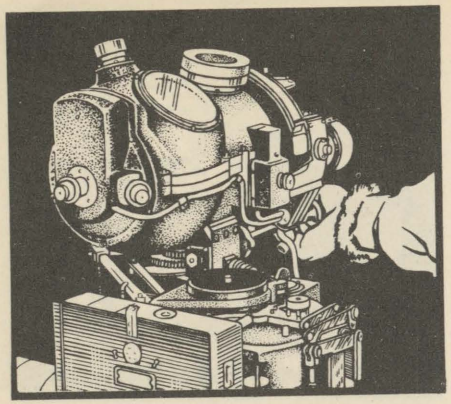


Engage the DIRECTIONAL CLUTCH.

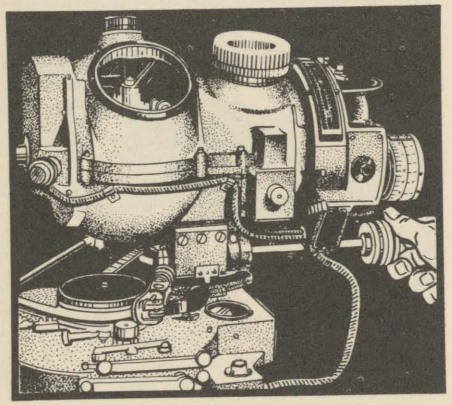


Disengage the SECONDARY CLUTCH and . . .

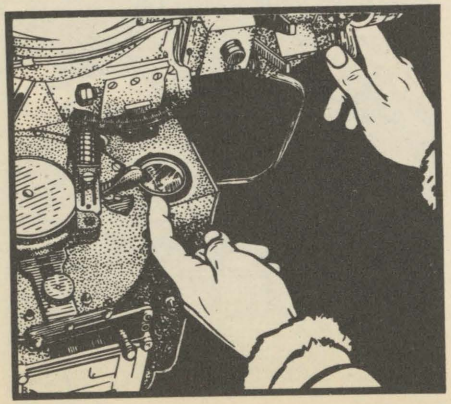




. . . manually try to turn the bomb sight. The sight should resist turning. Apply this torque for sufficient time to determine whether or not the servo motor is operating.

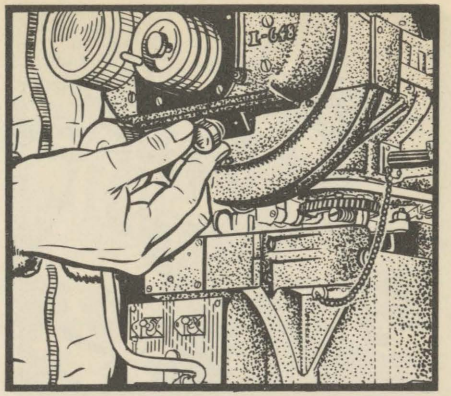


Turn the COURSE KNOB and . . .

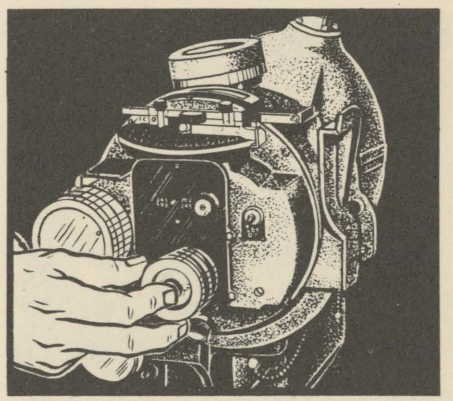


. . . the TURN KNOB. See that the PDI brush follows the movement smoothly through its entire operating range.

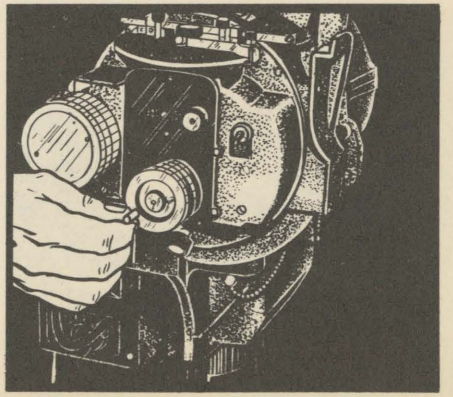
Turn the SEARCH KNOB slowly and check its action.

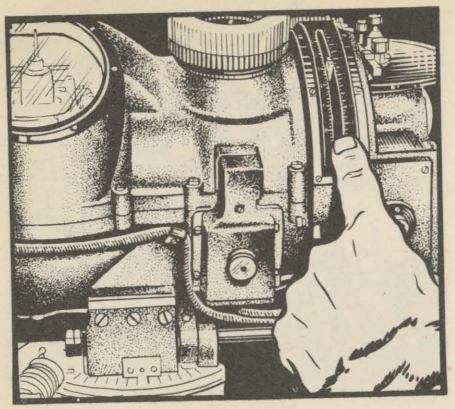


Engage the TELESCOPE CLUTCH and . . .

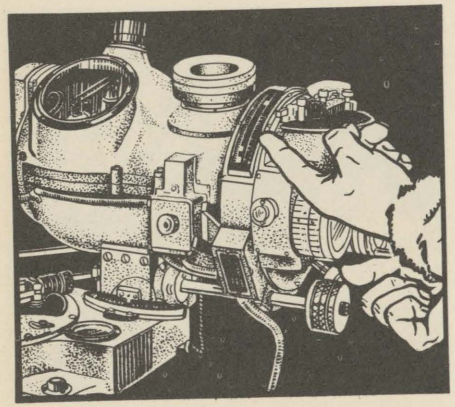


. . . turn the RATE DISPLACEMENT KNOB through its entire operating range, and then return it to the center position.

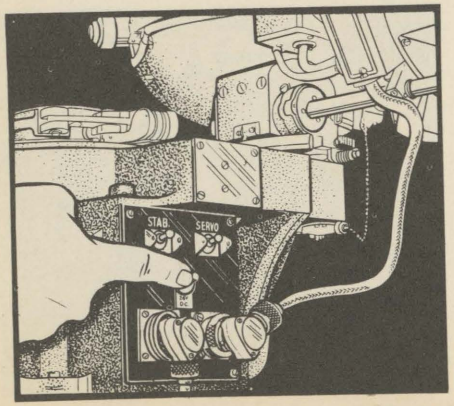




Turn the DISPLACEMENT KNOB. Return the optics to the 70 degree mark.

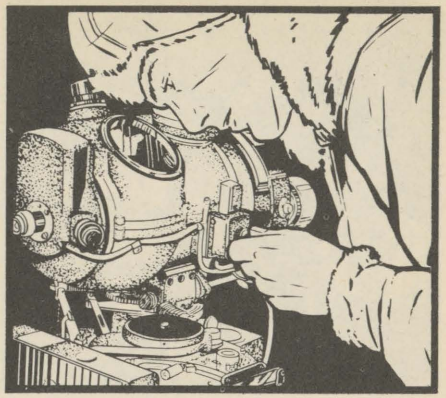


Check the action of the OPTIC KNOB. Return it to normal by pushing the knob in and turning it in a clockwise direction.

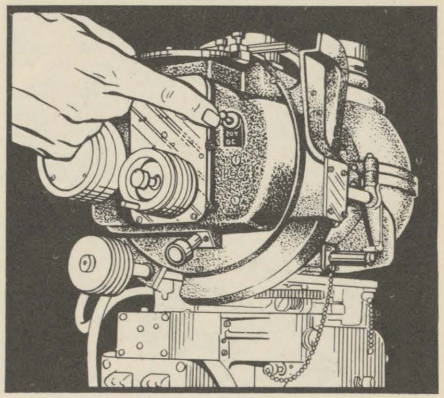


With the B.S. (bomb sight) GYRO caged, turn the B.S. switch to the ON position and . . .

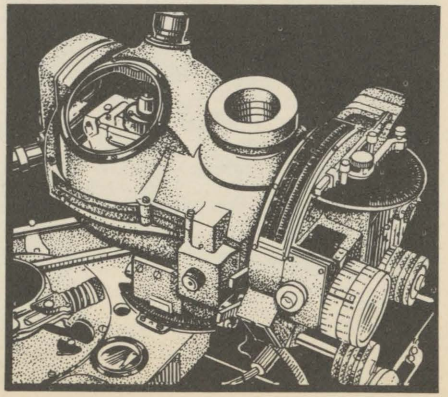
. . . check the illumination of the SIGHT BUBBLES and TELESCOPE CROSS HAIRS.

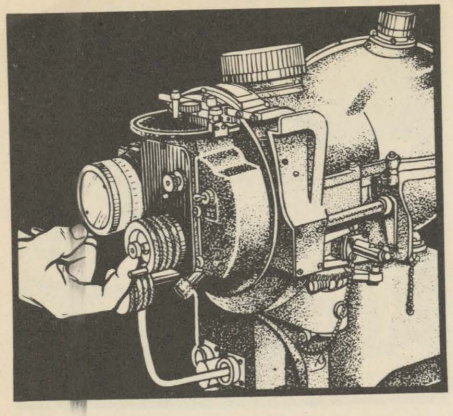


Turn the TELESCOPE MOTOR switch to the ON position and . . .

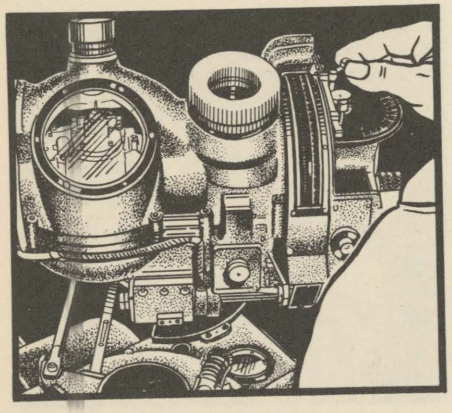


. . . check the travel of the OPTICS.

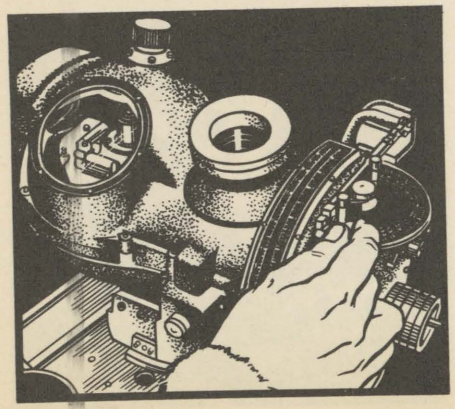




Disengage the CLUTCH.

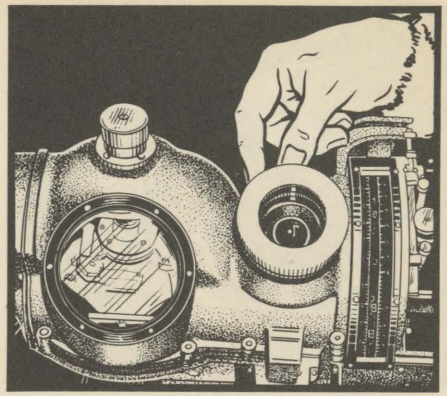


With zero TRAIL, turn the sight to its greatest DRIFT ANGLE. (Indices at 40 degrees.)

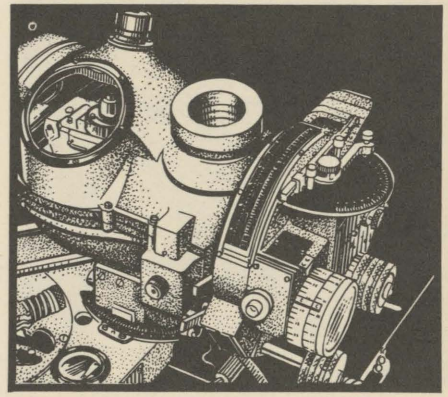


Set in MAXIMUM TRAIL and . . .

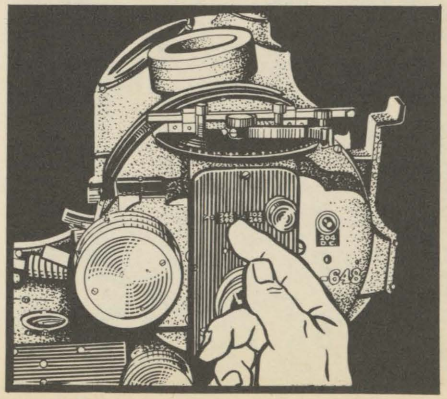
. . . see that the TELESCOPE tilts to its proper position.

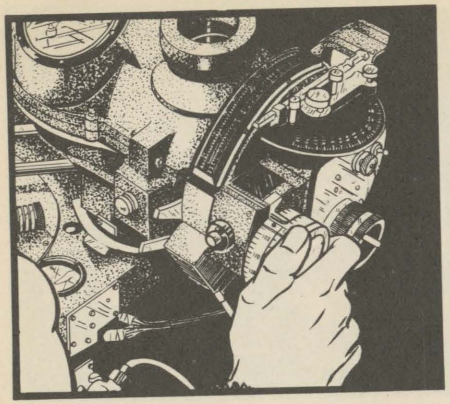


Return the trail arm to ZERO.

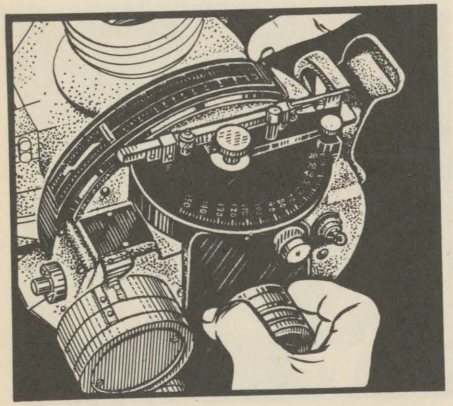


Engage the CLUTCH in the HIGH SPEED position.

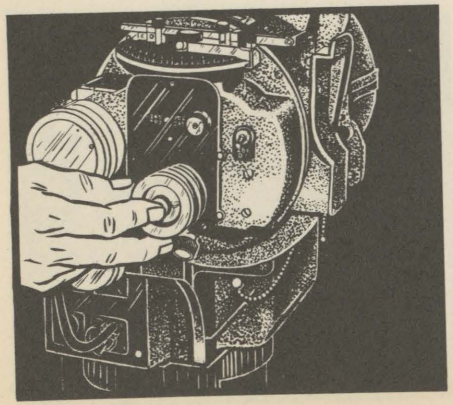




With the D.S. (disc speed) at its highest value . . .

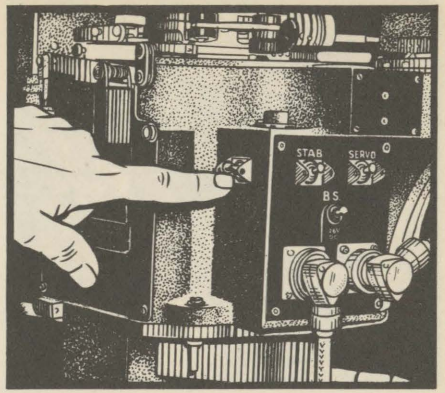


. . . set the RATE INDICATOR at minus 50 degrees.

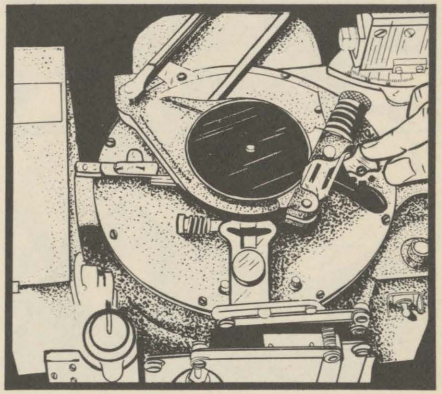


Engage the TELESCOPE CLUTCH and . . .

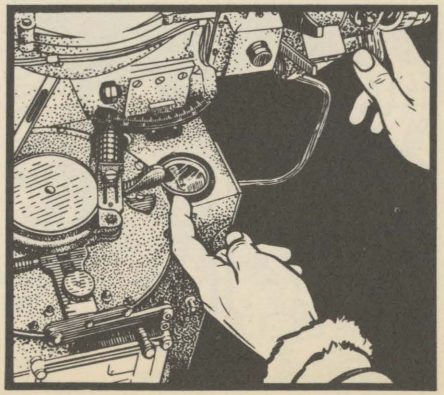
Turn the PDI switch to the ON position.

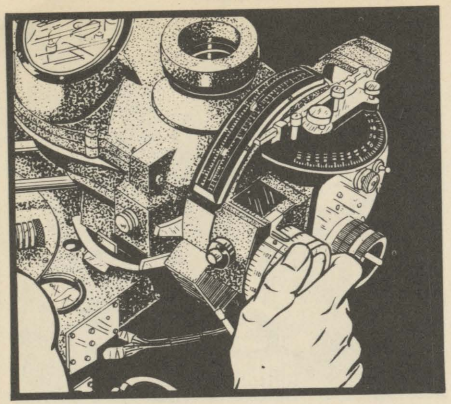


Open the ventilator which is located at the top of the STABILIZER.

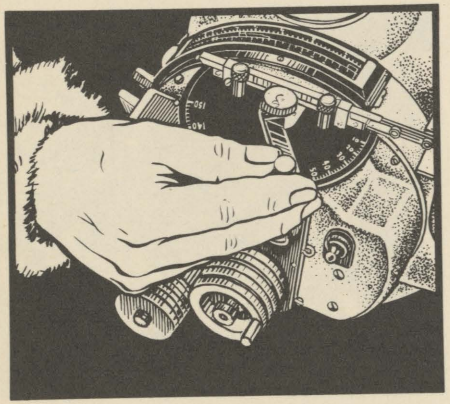


Check the PDI by moving the PDI brushes to both extreme positions and . . .

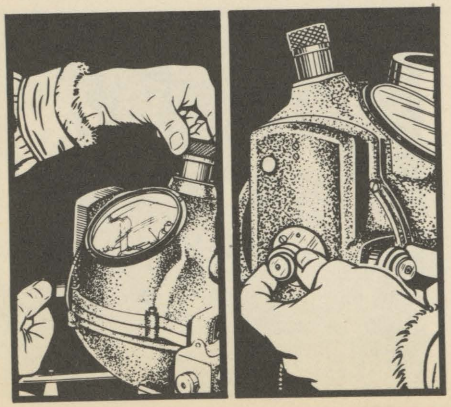




. . . the rate indicator should move downward. (The cross hairs will move backward.)

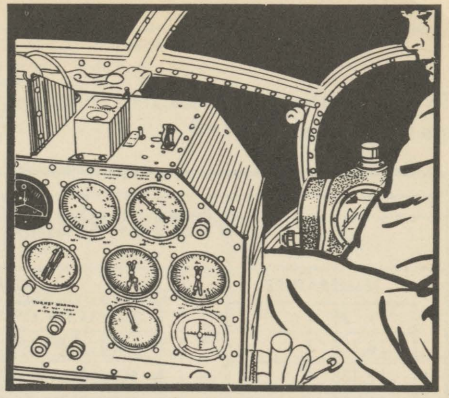


Set in the 50 mils TRAIL and the indicator (and cross hair) motion should cease.



Uncage the B.S. GYRO and check the action of both of the LEVELING KNOBS.

. . . . have the pilot call out the pointer positions on his PDI. flight indicator.



NOTES:

To compute the correct indicated altitude at which the bomb run is to be made, use the following form:

BOMBARDIER'S CHART

TEMPERATURE

19,135	
18,265	
17,385	
16,500	
15,610	
14,715	
13,810	
12,900	
11,990	
11,065	
10,140	
9,200	
8,265	18
7,315	20
6,365	22
5,400	24
4,435	26
3,460	28
2,480	
1,495	

6 | 138 | 23

TOTAL 23

—2
MEAN TEMP. 21

ALTITUDE COMPUTATION

ELEVATION OF TARGET	1060
PRESSURE ALTITUDE OF RUNWAY	2100
BOMBING ALTITUDE	8000
ELEVATION OF RUNWAY	1970
PLACE **BLACK LINE** PRESSURE ALTITUDE PLACE **RED LINE** OVER MEAN TEMPERATURE	
BOMBING ALTITUDE	8000
PLUS ELEVATION OF TARGET	+1060
	9060
MINUS ELEVATION OF RUNWAY	−1970
EQUALS DESIRED ALTITUDE	7090
PLACE TRUE ALTITUDE UNDER **RED LINE** READ INDICATED ALTITUDE ABOVE RUNWAY UNDER **BLACK LINE**	6700
ADD PRESSURE ALTITUDE OF RUNWAY	2100
C.I.A. TO FLY	8800

FORM 3AA-1

(SEE INSTRUCTIONS ON THE REVERSE SIDE)

PILOT FORM

BOMBARDIER Lt. Smith, J. DATE

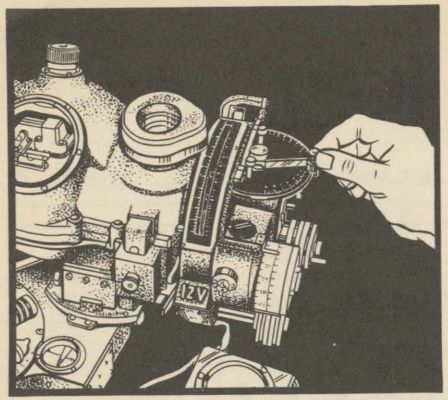
PILOT Capt. Jones AIRPLANE NO. TYPE B-29

1	2	3	4	5	6	7	8	
RELEASE NUMBER	GIAS	COMPASS READING	ALTITUDE DIFFERENCE	LENGTH OF RUN	W	V	T	REMARKS
1	153	100°	8900	30 sec.	G	G	S	
2	153	195°	8900	32 sec.	G	G	S	
3	158	287°	8900	28 sec.	G	G	S	
4	164	350°	8900	38 sec.	G	G	S	
5	164	75°	8900	35 sec.	G	G	S	
6								
7								
8								
9								
10								

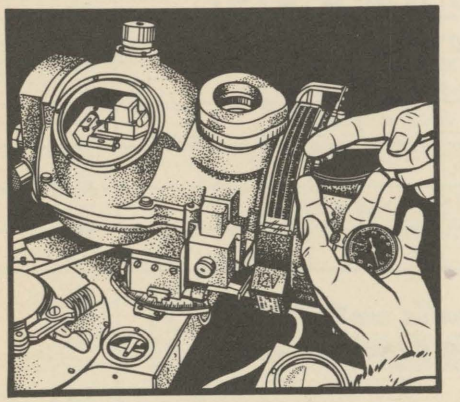
REMARKS: Telescope motor did not drive the rate end at a constant speed.

D. T. No. 1

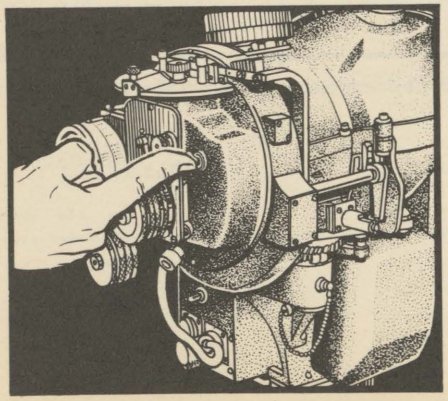
This form should be used during the bombing runs to record the data for future reference.



With D.S. and TRAIL set into the sight, set in the approximate dropping angle to be used on the bombing run.

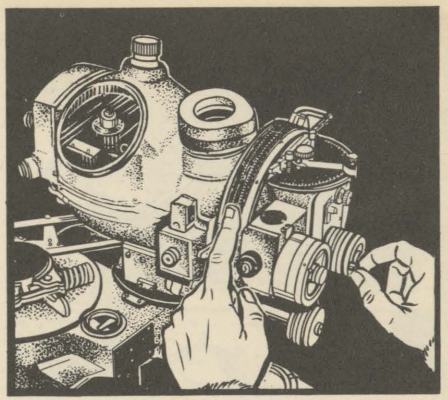


Time the indices and determine where the telescope should be to give the length of the run desired.

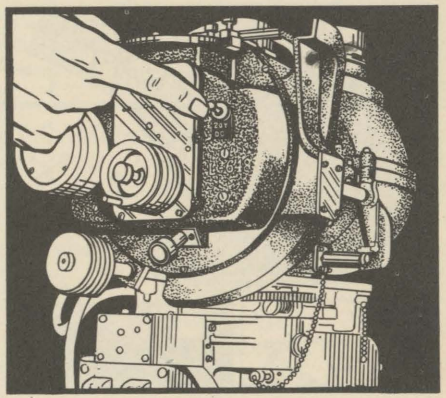


Turn off the TELESCOPE MOTOR and . . .

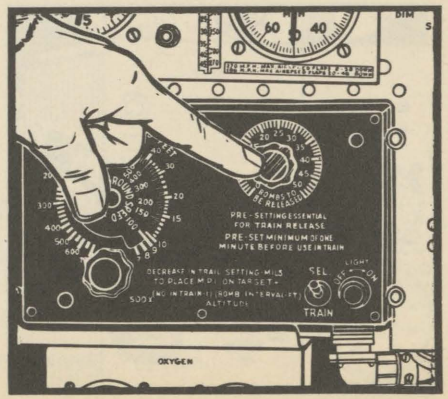
. . . roll the INDICES back to the desired position.

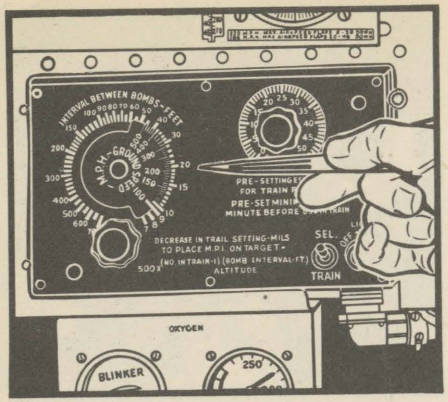


Turn the TELESCOPE MOTOR to the ON position when the target appears in the optics.

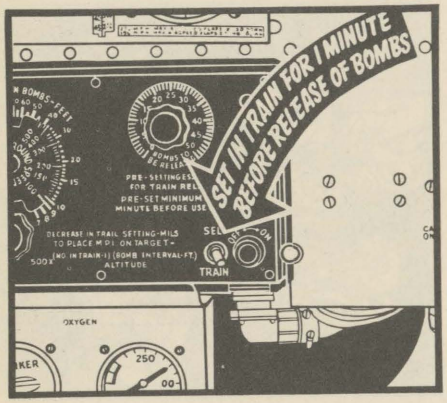


Set the pointer of the TRAIN RELEASE KNOB to the indication showing the number of bombs to be dropped.

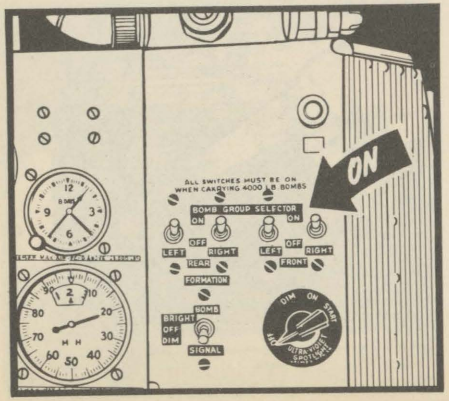




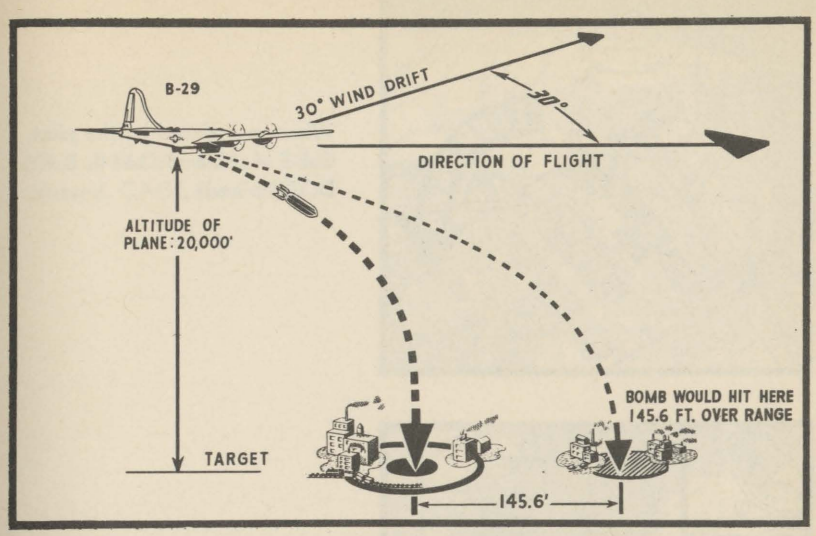
Set the INTERVALOMETER to the indication showing the desired interval between bombs. This determines the distance between the bombs upon impact on the ground.



Set the INTERVALOMETER SELECTOR switch to the TRAIN position. NOTE: For one minute prior to release of the bombs, the switch should be on TRAIN to allow time for the tubes to get warm.



Set the BOMB GROUP SELECTOR switches to the ON position. This will be determined by the groups of bombs to be dropped. NOTE: When using 4000 pound bombs, all selector switches must be at the ON position.



Consideration must be given to the R.C.C.T. (range component of cross trail) for bombs with high trail values (like M-38-A2) at high altitudes with large drift values. For instance, at 20,000 feet, with a 30 degree drift, an error of 145.6 feet over in range can result due to R.C.C.T.

R.C.C.T. = T (1-Cos θ); when T = trail in feet.

DATA

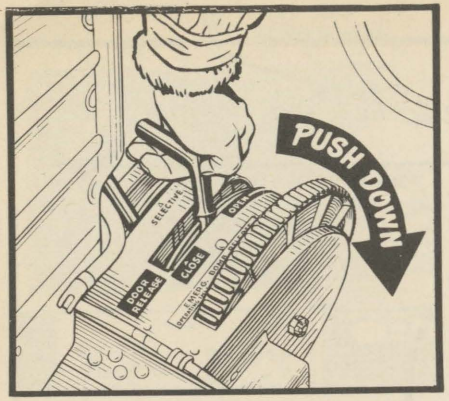
COSINE	APPROXIMATE PER CENT OF T
10°—.985	1.5
15°—.965	3.5
20°—.939	6.0
25°—.906	9.4
30°—.866	13.4

FORMULA

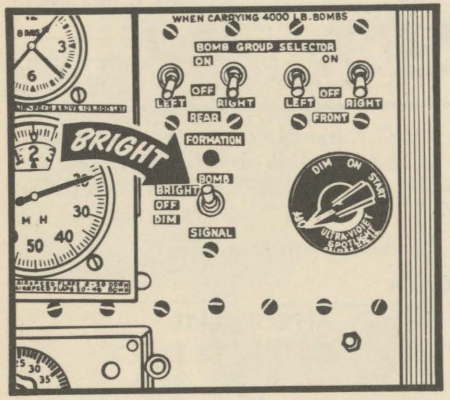
$$G.S. = \frac{(\text{Tan } \theta)\ (\text{Alt}) + T}{ATF}$$

ERROR equals ½ tan θ (error in altitude) (in feet)

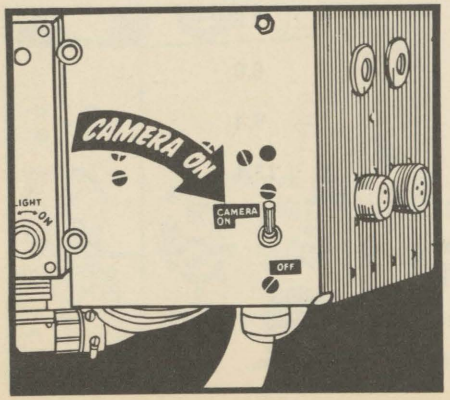
(on ground) 1 mil equals approximately 2½ rpm.



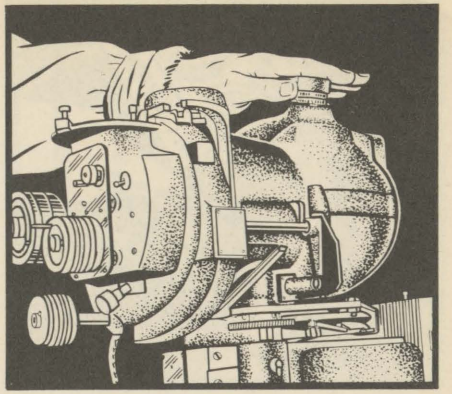
When so ordered by the pilot, OPEN the BOMB BAY DOORS and . . .



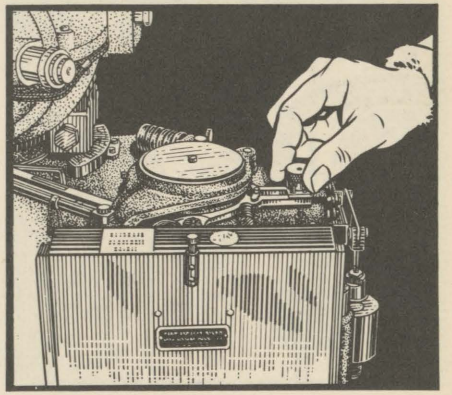
. . . set the BOMB SIGNAL LIGHT at BRIGHT. At the same time . . .



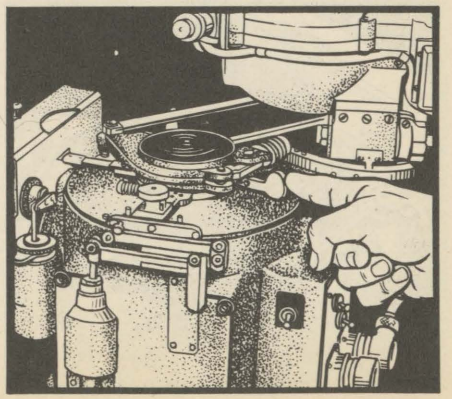
. . . set the CAMERA switch to the ON position.



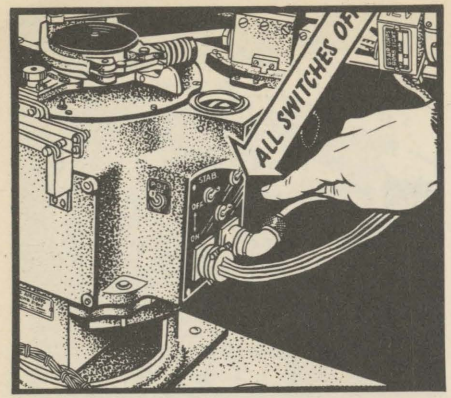
After all the bombs have been released, CAGE the GYRO.



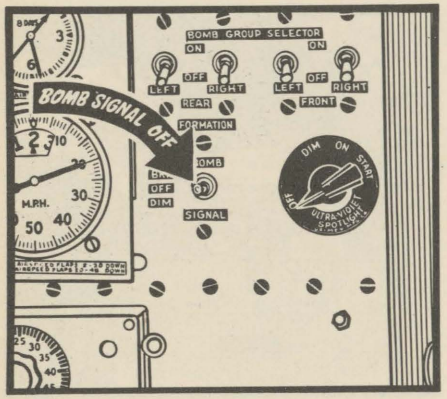
Engage the SECONDARY CLUTCH by turning the thumb nut in a clockwise direction.



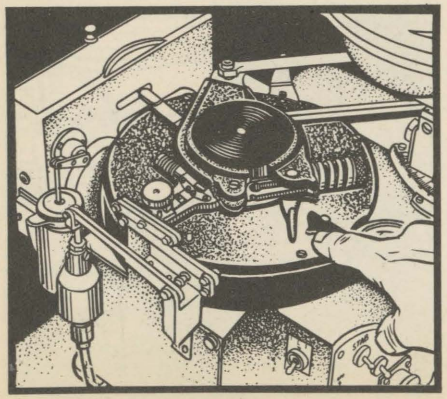
Disengage the DIRECTIONAL CLUTCH.



Turn all switches to the OFF position.

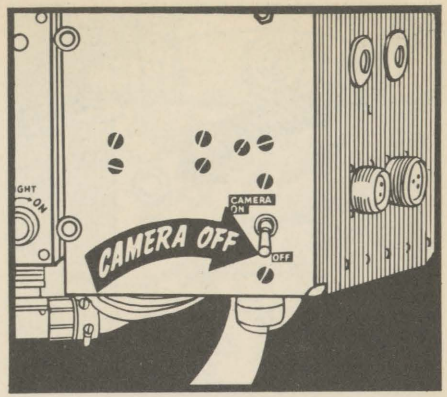


Make sure the BOMB SIGNAL LIGHT is turned OFF.

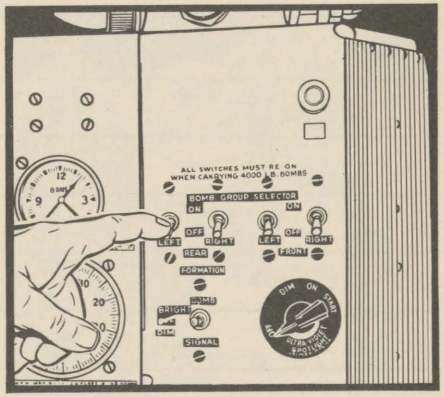


Close the VENTILATOR which is located on the top of the bomb sight STABILIZER.

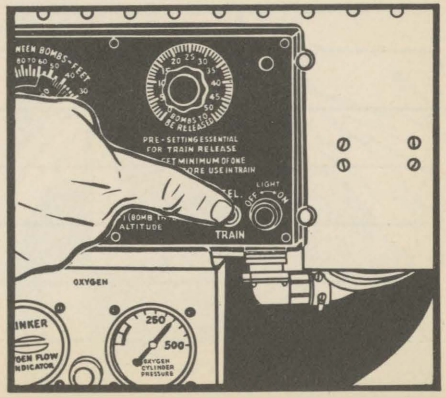
After the bombs have exploded on the target, turn the CAMERA switch to the OFF position.



Set all the BOMB GROUP SELECTOR switches at the OFF position.

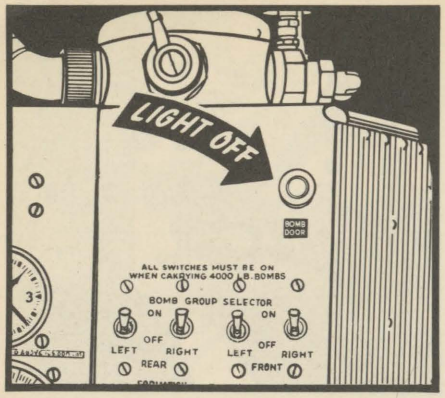


Set the INTERVALOMETER TRAIN switch at SELECT.



DURING FLIGHT

BOMBARDIER



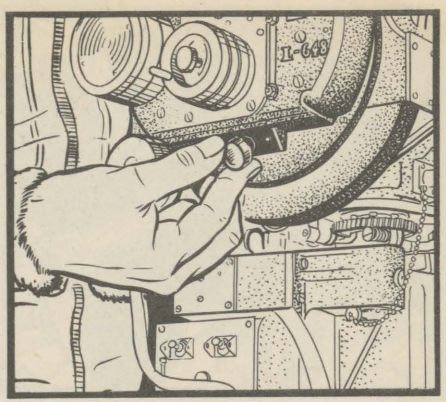
Check and see that the BOMB DOOR WARNING LIGHT is OFF, indicating that the doors are closed.

NOTES:

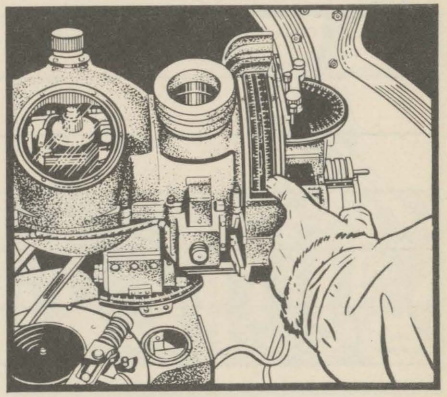
BEFORE LANDING

BOMBARDIER

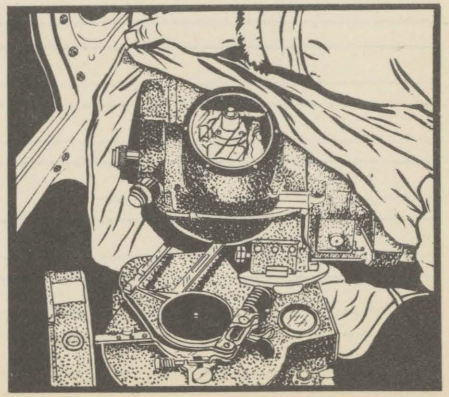
Set the TELESCOPE to the 70 degree mark with extended vision rolled out.



Set the DROPPING ANGLE at approximately .70.

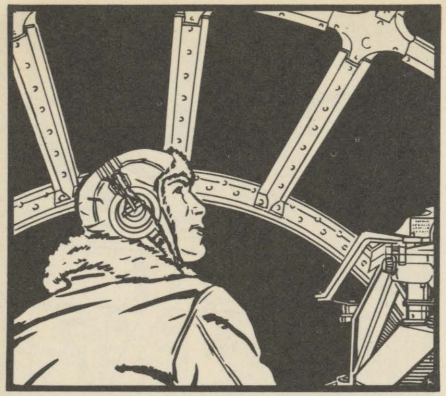


Place the cover over the bomb sight.



BEFORE LANDING

BOMBARDIER

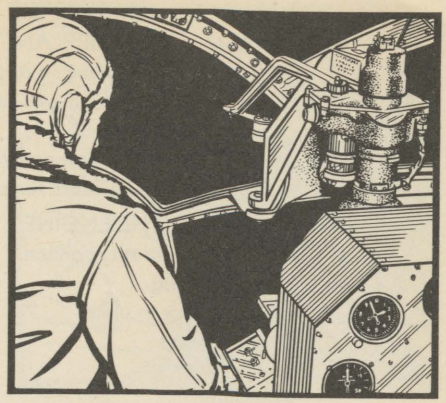


Fill out your reports. Make observations as directed by the pilot.

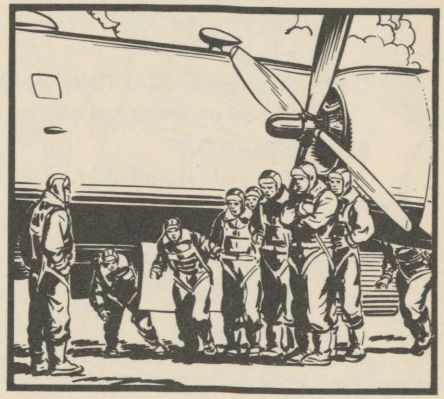
NOTES:

AFTER LANDING

BOMBARDIER



Before leaving the airplane, see that the combat station is in order.



Report to the flight engineer any malfunctioning of equipment. Then, hand in completed reports to the pilot. When instructed by the pilot, leave the airplane and join the formation for inspection by the pilot.

NOTES:

GUNNER'S CHECK LIST

BEFORE ENTERING THE AIRPLANE
- Remove gun and turret covers.
- Check ammunition and gun loading.
- Check gun camera.
- Assist other crew members with visual inspection.
- Prepare personal effects for pilot's inspection.

BEFORE STARTING THE ENGINES
- Earphones and microphone.
- Turret latching.
- Auxiliary power plant.
- Sight stowage.
- Lamps and fuses.
- Parachute.
- Clothing.
- Oxygen.
- Life preserver.

DURING ENGINE STARTING AND WARM-UP
- Report movement of control surfaces.

BEFORE TAKE-OFF
- Taxi and take-off alert.
- Amplidyne.
- Computer stand-by.
- Turret transfer.
- Safety belt.

DURING FLIGHT
- Operational check of sight, guns and turrets.
- Enemy aircraft alert.
- Approaching combat.
- During combat.
- After combat.

BEFORE LANDING
- Stowage of equipment.
- All switches.
- Report movement of control surfaces.

AFTER LANDING
- Ammunition.
- Reports.
- Removal and cleaning of guns.

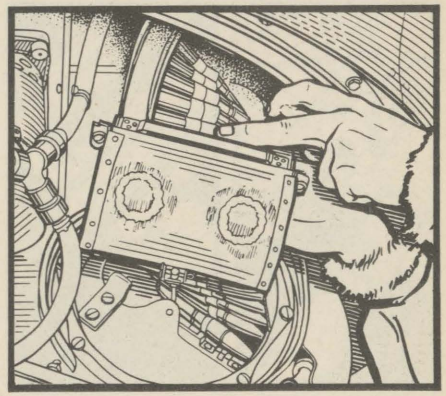
BEFORE ENTERING THE AIRPLANE

GUNNERS

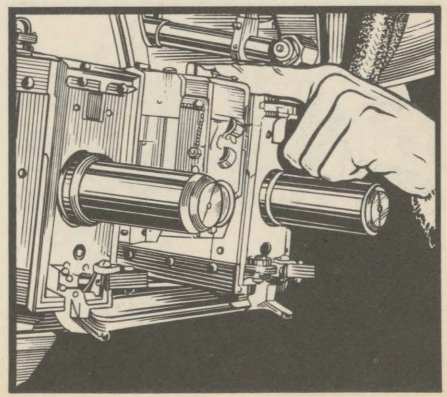
Remove all the COVERS from the TURRETS and GUNS.

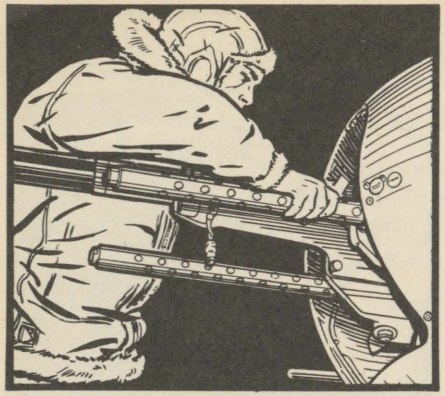


See that the AMMUNITION is properly loaded into the guns and that it moves freely in the chutes.

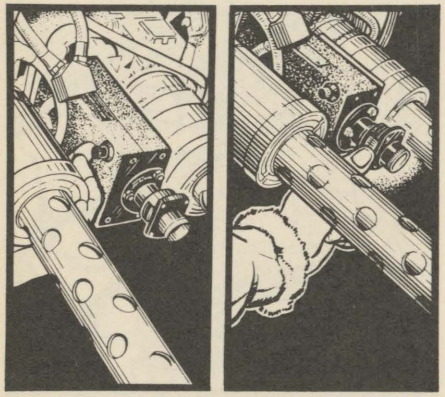


Reset the GUN CHARGERS.

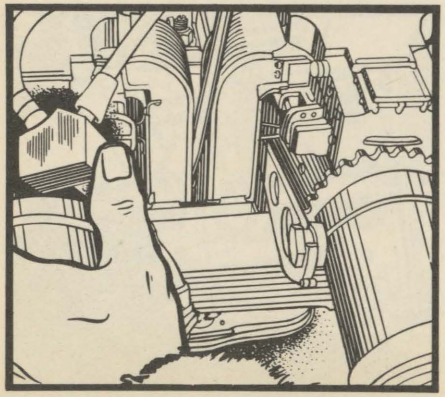




The tail gunner will check and see that the 20 mm. gun is loaded properly.

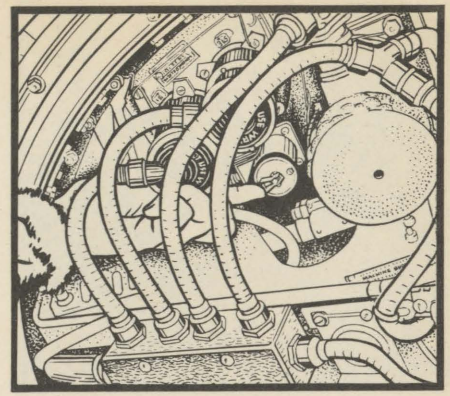


See that the GUN CAMERA is loaded properly and is set for a speed of 16 frames per second and adjusted for the brightness of the day.

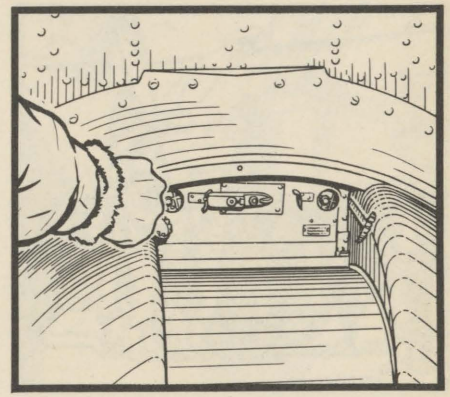


See that the LINK CHUTES are properly inserted in the CHUTE HOLDERS and that the GUN MOUNTING BOLTS are safety-wired.

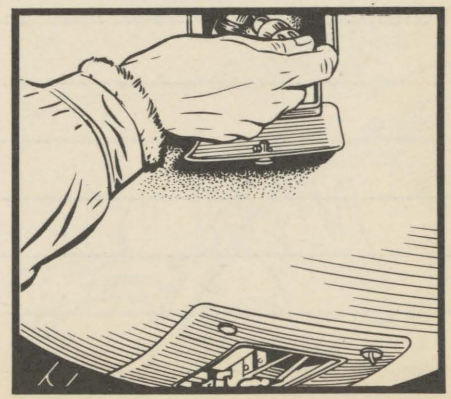
Stow the turret so that the guns are pointing to the rear and lock them in that position with the AZIMUTH LATCH.



Replace the turret covers (domes) and look through the doors and front inspection holes to make sure they are securely latched into place.

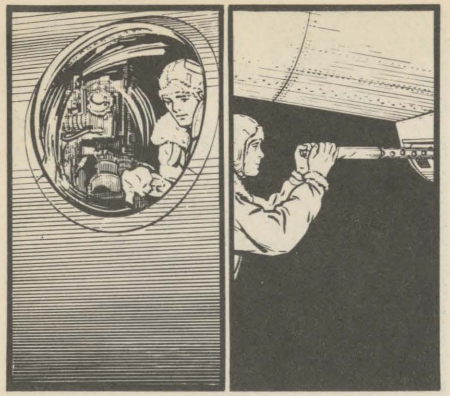


Stow the turret so that the guns are at their proper elevation and lock them in that position with the ELEVATION LATCH.

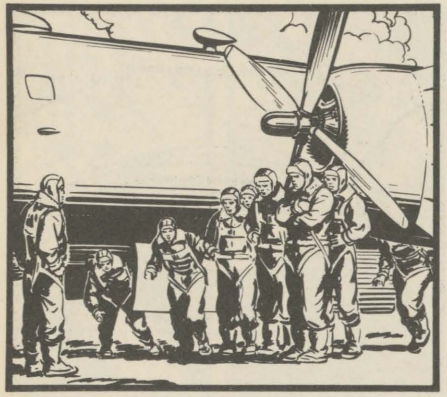


BEFORE ENTERING THE AIRPLANE

GUNNERS



Assist the pilot and other crew members with their visual inspection of the airplane.



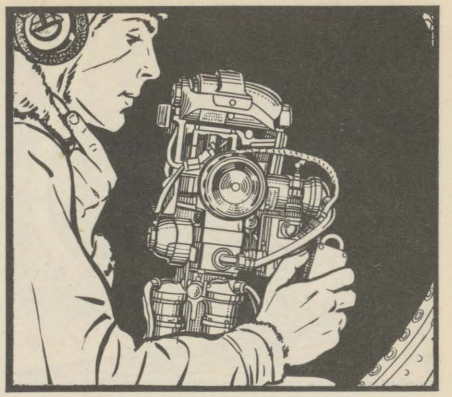
Prepare your personal effects for inspection by the pilot.

NOTES:

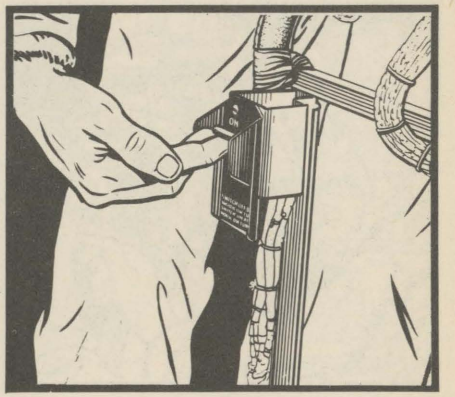
BEFORE STARTING THE ENGINES

GUNNERS

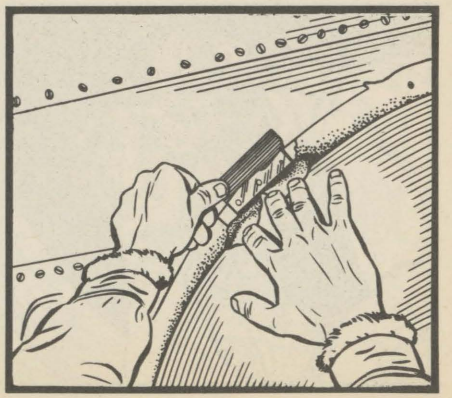
Enter the airplane. Adjust your EARPHONES and THROAT MICROPHONE. Stand by for INTERPHONE check.

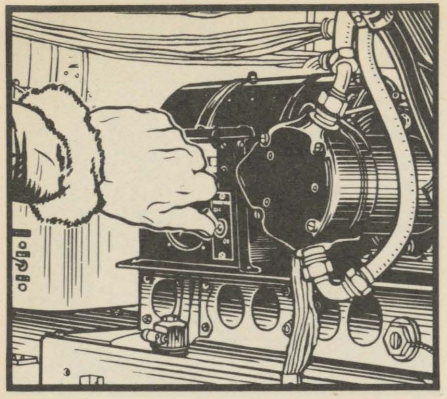


All gunners will see that the lower aft TURRET SAFETY switch is in the ON position.

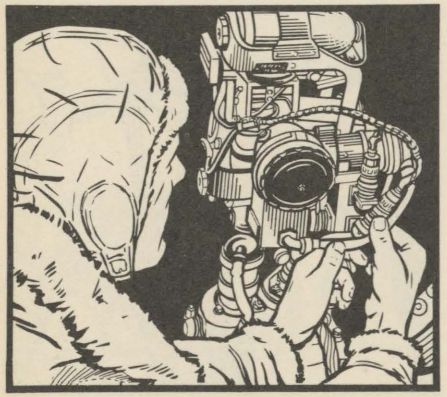


See that the TURRET WELL COVERS are tight so that the turret safety switches will lock.

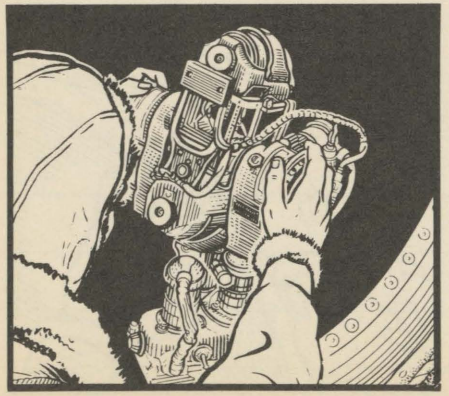




When so ordered by the flight engineer, the tail gunner will start and operate the AUXILIARY POWER PLANT. NOTE: Starting, running and stopping the AUXILIARY POWER PLANT will be accomplished in accordance with the check list. (See "MISCELLANEOUS DATA" section of this manual.)

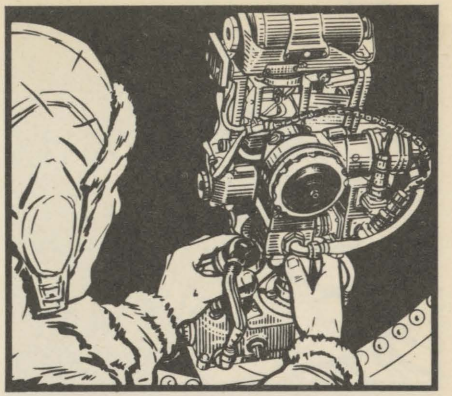


Check all AN CONNECTORS to see that they are properly fastened.

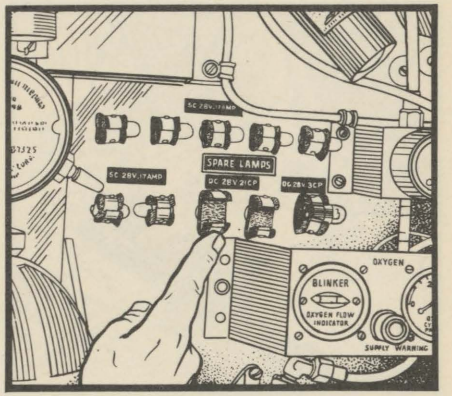


Check all ROTATING MECHANISMS and GROUND STRAPS.

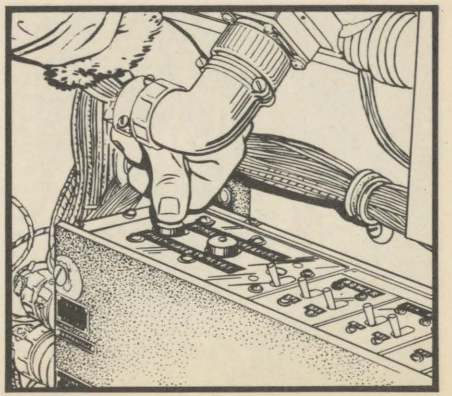
Check and see that all the SELSYN CAPS are tight.

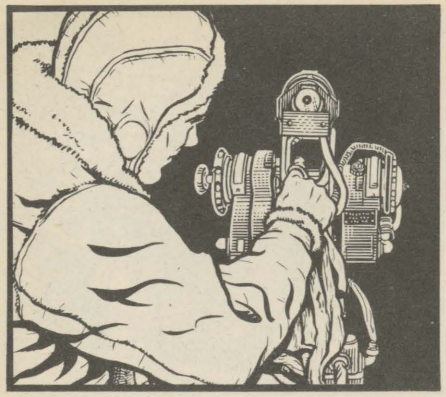


Be sure that spare VACUUM TUBES, GLOW LAMPS, and FILAMENT LAMPS are on hand.

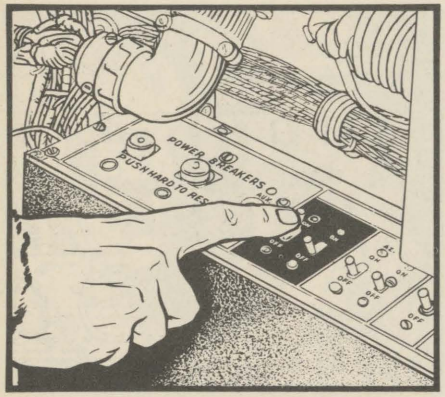


Reset all of the CIRCUIT BREAKERS.

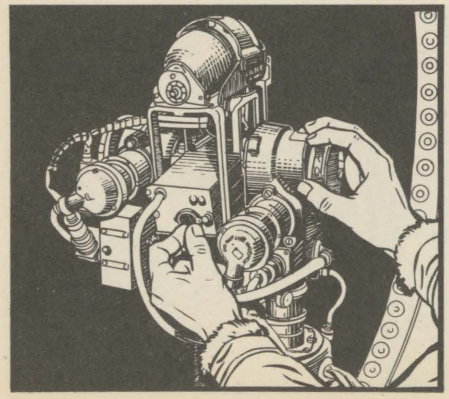




Make sure that the OPTICS of all the sights are clean.

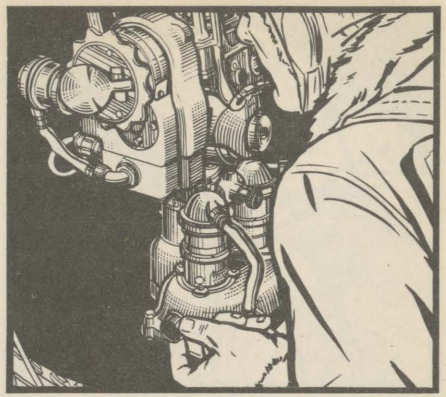


After the auxiliary power plant has been started, turn the DYNAMOTOR switch to the ON position.

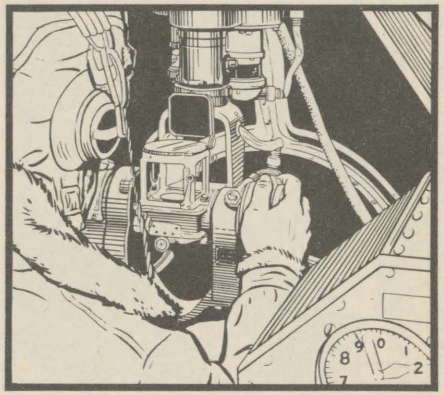


Check both FILAMENTS of the RETICLE LAMP.

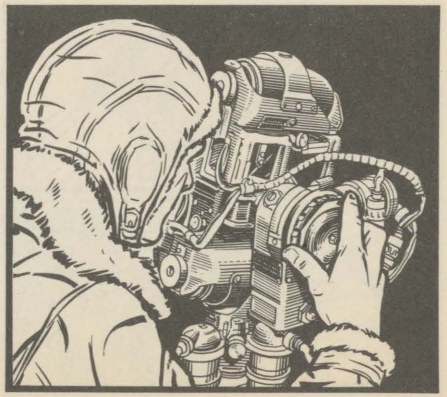
Check the filament lamp RHEOSTAT and set it to the desired brightness.

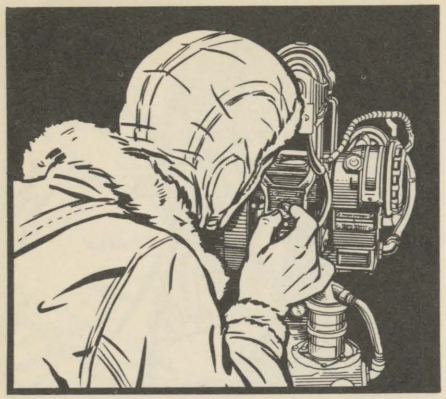


The bombardier will check his PANTOGRAPH for freedom of movement and make sure that the pantograph ARM LATCH is in proper working condition.

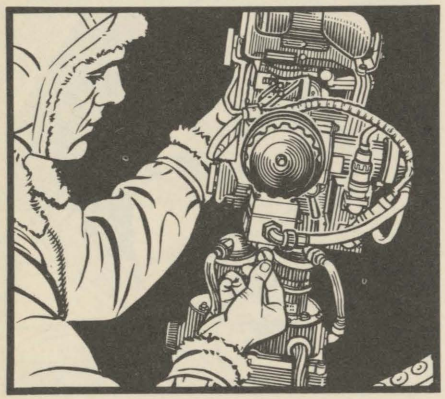


Check the movement of the sight RETICLES while turning the range knob. Set the RANGE KNOB for maximum range.

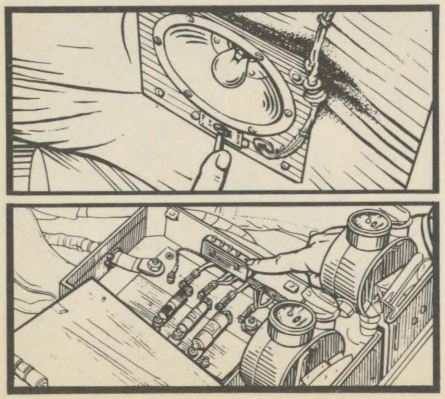




Check the WING SPAN adjustment and set it for the expected type enemy aircraft. Then turn the DYNAMOTOR switch to the OFF position.

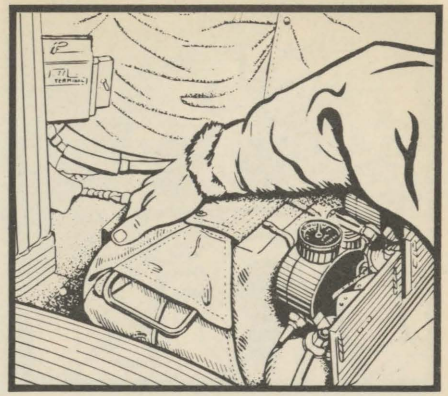


See that the SIGHTS at your station are properly stowed. Normally, they are stowed aft and in a horizontal position since the turrets must be so positioned for landing.

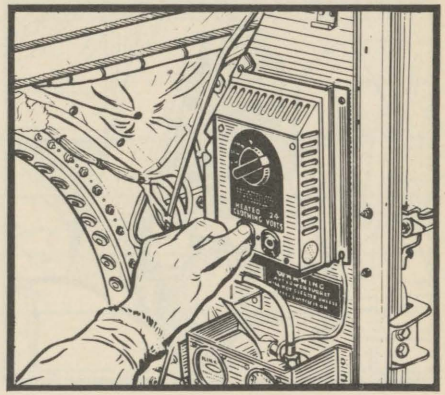


Check all the LIGHTS at your station. Be sure that SPARE FUSES are on hand.

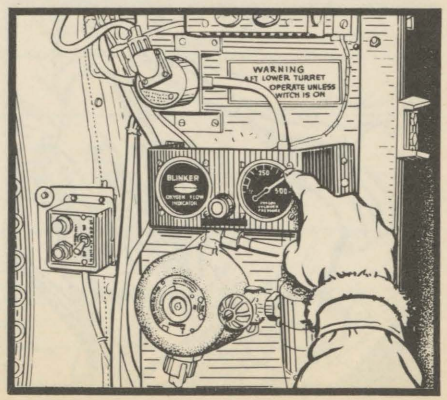
Fasten your PARACHUTE HARNESS and place the parachute pack so that it is within easy reach.



Plug in the connector of your HEATED FLYING SUIT. Be sure that the RHEOSTAT is in the OFF position. Try the various circuits. Be sure that each circuit operates properly and that the elements in your suit supply heat.

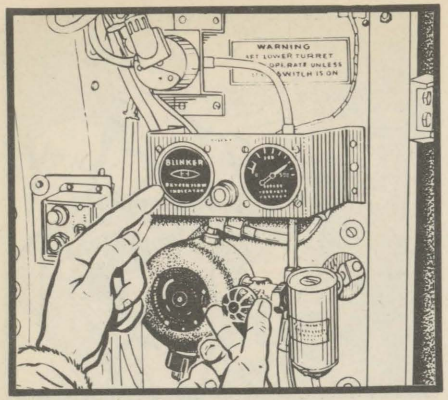


Check your OXYGEN CYLINDER GAGE for a pressure indication of 400 to 425 pounds per square inch. Turn the DEMAND REGULATOR to the ON position. The BLINKER will indicate when the oxygen is flowing.

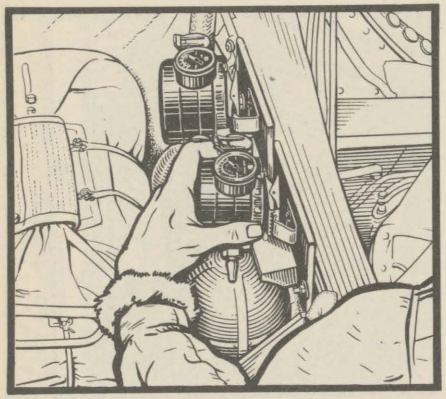


BEFORE STARTING THE ENGINES

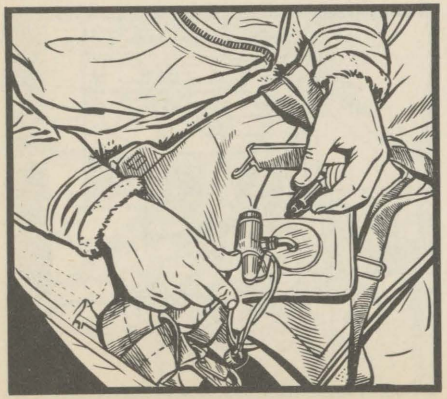
GUNNERS



When the regulator knob is turned to EMER. ON, the blinker will remain open.



See that a fully charged PORTABLE OXYGEN BOTTLE is within easy reach.

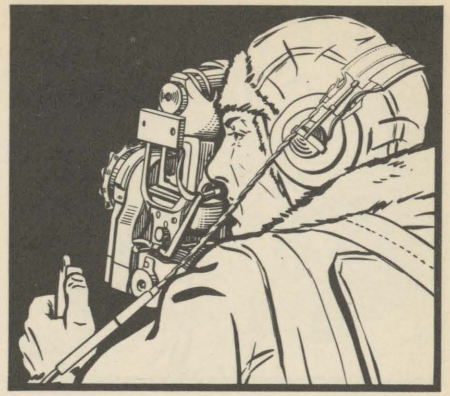


Check the condition of your LIFE PRESERVER and CO_2 CYLINDER. See that the CO_2 cylinder puncturing arm is safetied.

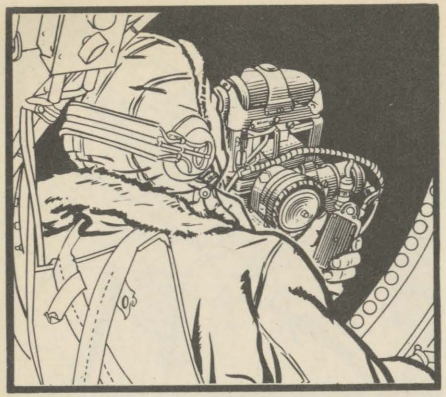
DURING ENGINE STARTING AND WARM-UP

GUNNERS

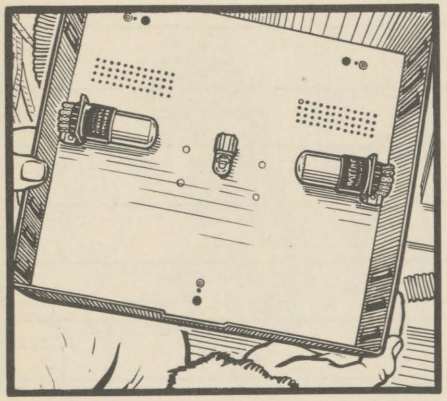
The right and left side gunners will report to the co-pilot the operation of the wing flaps. The top gunner will report the action of the ailerons, elevators and rudder. The rear and side gunners will report the status of their check lists to the gun commander.



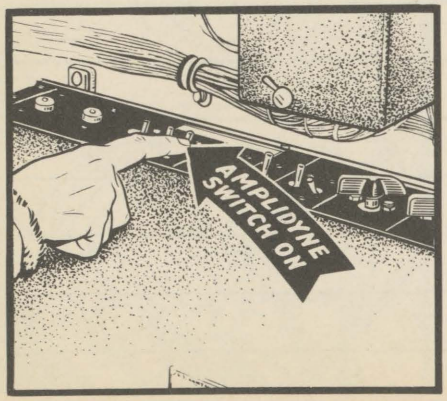
NOTES:



Upon the order "Stand by to taxi," all gunners will be alert for other aircraft and obstructions to the rear and to both sides of the airplane. Report immediately to the pilot any abnormal conditions such as smoking engines, etc.

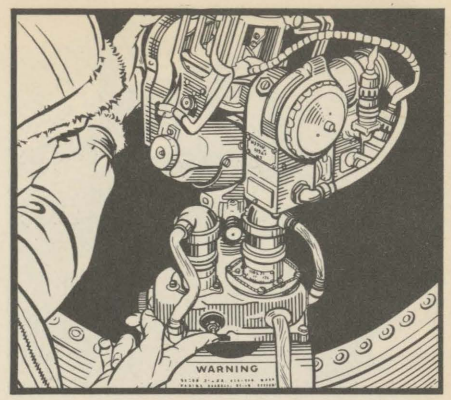


Check the inside cover of the SERVO AMPLIFIER for SPARE TUBES and LAMPS.

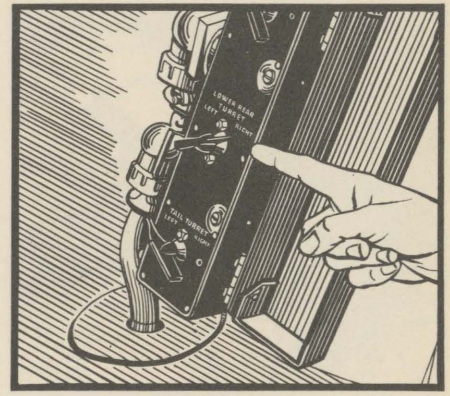


Turn the AMPLIDYNE switch to the ON position.

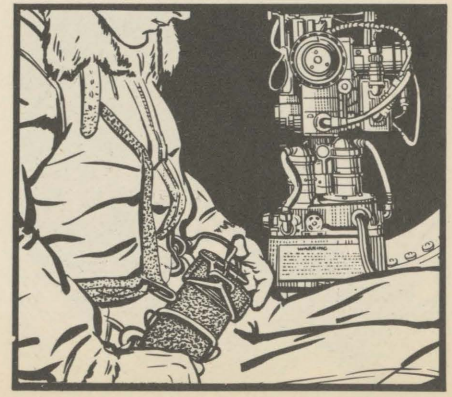
Turn the COMPUTER STAND-BY switch to the IN position.

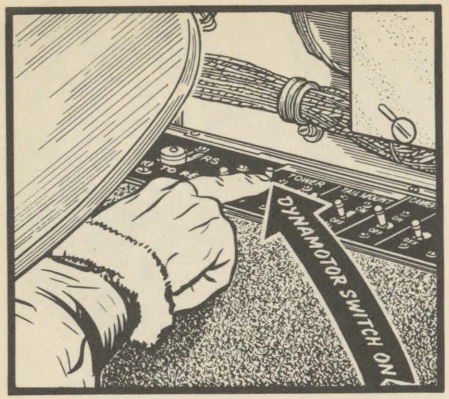


Check the TURRET TRANS-FER switch and see that it is placed in position for control by the right gunner.

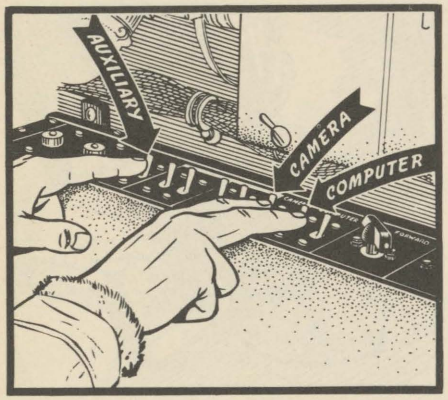


Fasten your safety belt.

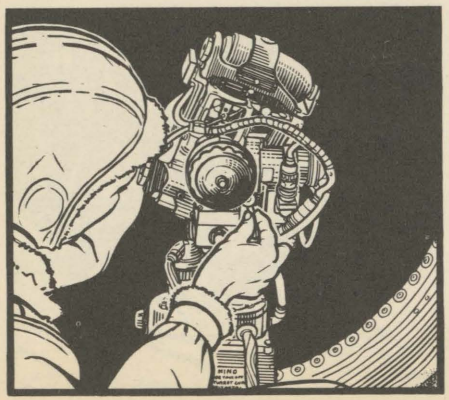




When so ordered by the gun commander, turn the DYNAMOTOR switch to the ON position.

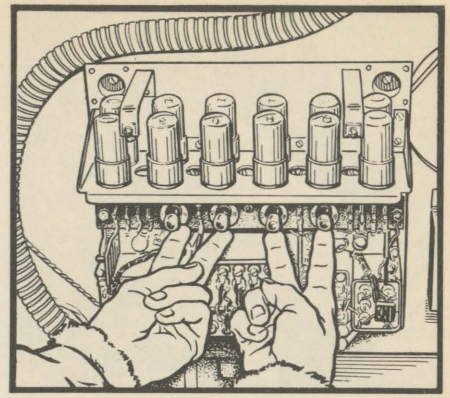


Upon order from the gun commander, the gunner checking the system from his sight will then turn the AUXILIARY, CAMERA and COMPUTER switches to the ON position.

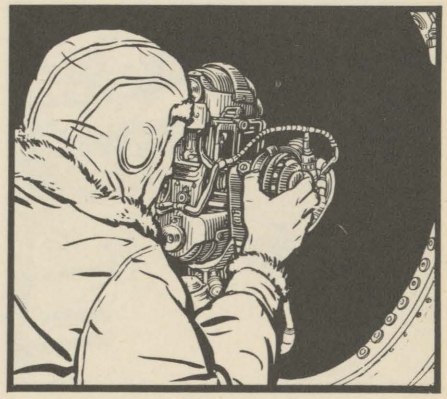


Release the STOWING LATCHES on the sight.

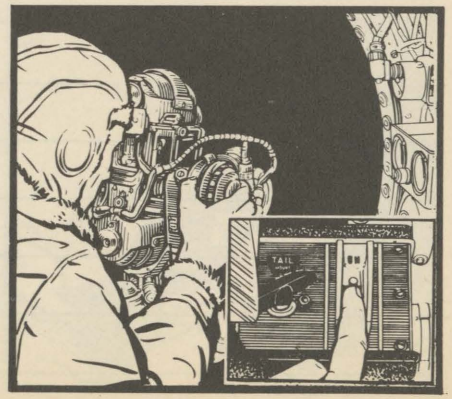
Remove the cover from the SERVO AMPLIFIER and check the GLOW LAMPS.

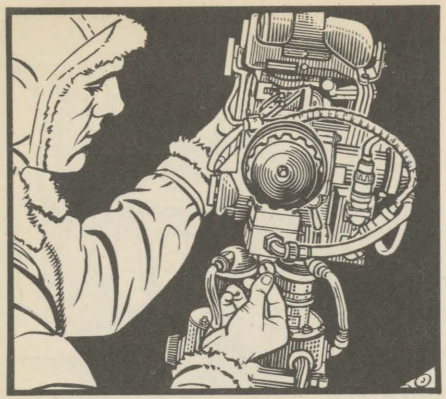


Move the sight until it is approximately aft and horizontal. Close the ACTION switch. Move the guns in AZIMUTH and in ELEVATION. Each set of lamps should glow and go out as the turret is moved.

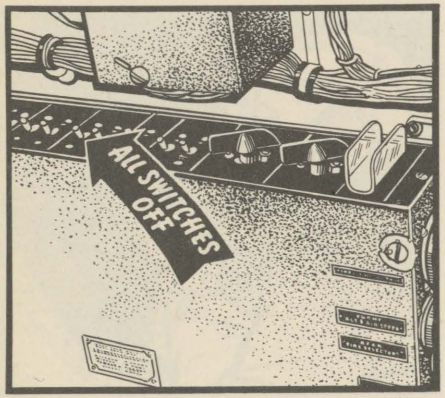


At the discretion of the gun commander, the FIRE - SAFE switch will be set at the FIRE position and the gunner will fire a burst of about four rounds of ammunition while operating the turret.





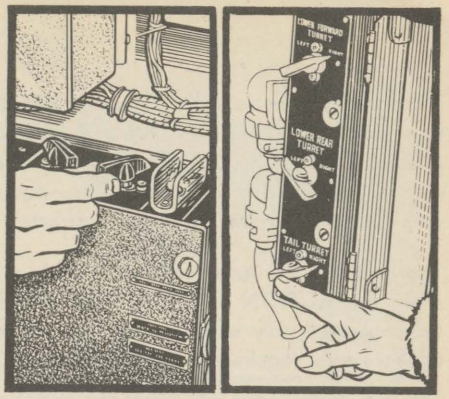
Stow the sight and turret in AZIMUTH and ELEVATION. Release the ACTION SWITCH.



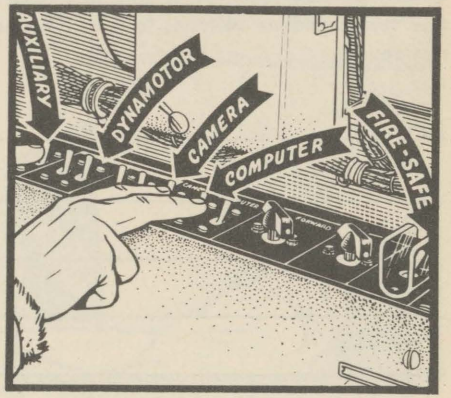
Turn OFF all SWITCHES. Repeat this procedure for each sighting station as directed by the gun commander.

NOTES:

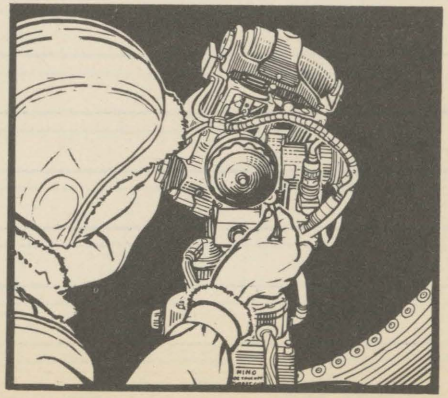
After each gunner's station has been checked for proper operation, the SECONDARY and TRANSFER switches shall be set as directed by the gun commander.



Upon entering the ZONE of ENEMY OPERATIONS, the AUXILIARY, DYNAMOTOR, CAMERA, COMPUTER, and FIRE - SAFE switches will be set at the ON positions.



The gun sight STOWING LATCHES will be RELEASED. All gunners will be on the alert for enemy aircraft.



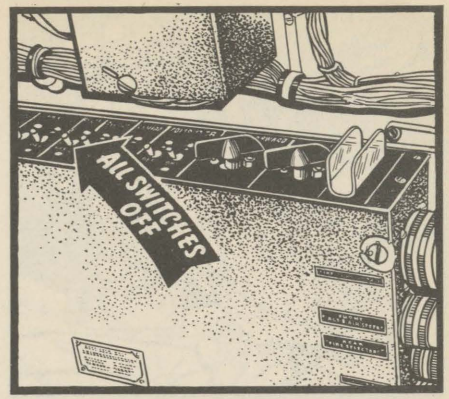
Immediately upon detection of enemy aircraft, the gunners will report to the gun commander the TYPE and NUMBER of ENEMY AIRCRAFT and indicate their position by the CLOCK METHOD. For example, "Right blister—enemy at 4 o'clock—believed 3 Messerschmitts—about 3 miles". The gunners will turn the amplidynes ON in the sequence as directed by the gun commander.

The gunners will have control of their respective turrets which will operate when the ACTION SWITCHES are DEPRESSED. The action switches should be depressed only when tracking the enemy so that the amplidynes are not unnecessarily required to move the turret against the wind load.

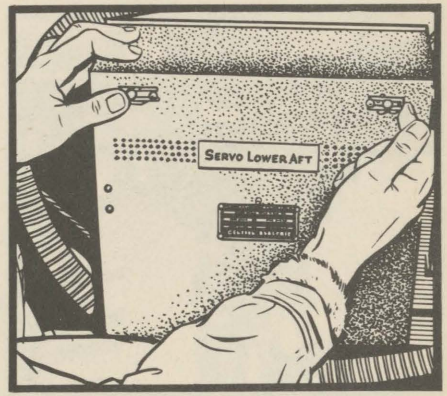
The gun commander will direct the switching of turrets to the various gunners by interphone. After the attack, the gunners will stow the sights and turrets and turn the amplidyne switches to the OFF position as directed by the gun commander.

NOTES:

Upon leaving the combat area, the gun commander will direct the FIRE-SAFE, AUXILIARY, DYNAMOTOR, COMPUTER, and CAMERA switches to be set at the OFF (or SAFE) positions.



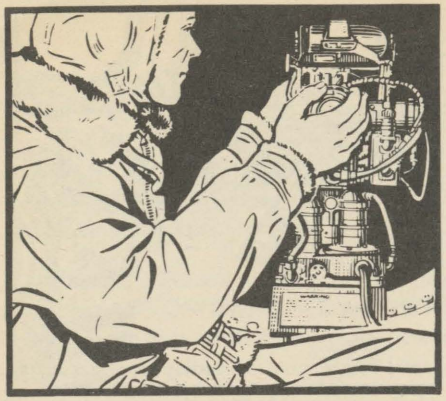
The gun commander will have the SERVO AMPLIFIER COVERS replaced, and will check with the pilot to see that the turret position indicating lamps are not glowing.



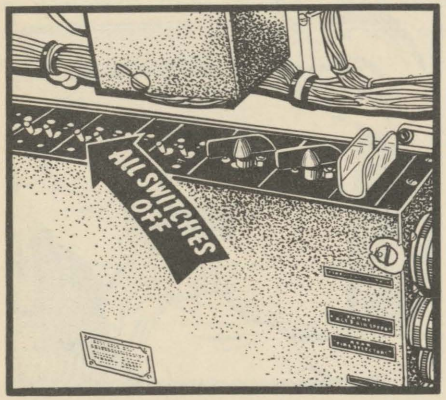
NOTES:

BEFORE LANDING

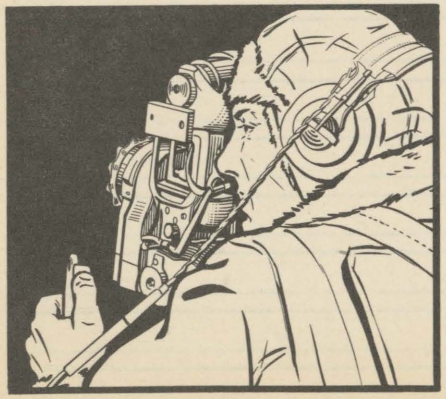
GUNNERS



The SIGHT and TURRETS (except the upper forward turret) should be pointed aft when stowed. The top gunner will check with the pilot to make sure that the turret position indicating lights are OFF.



Turn all gun control switches to the OFF positions.



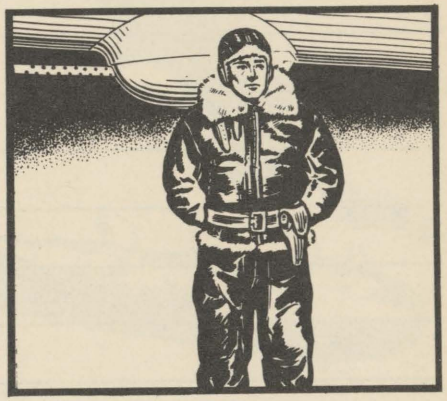
The side gunners will report to the pilot when the LANDING GEAR and WING FLAPS are extended.

AFTER LANDING

GUNNERS



Note the number of rounds of ammunition fired. Fill out the report on malfunctioning and hand it in to the gun commander.



The gun commander will appoint a guard for each turret until all of the guns have been checked and unloaded and the guns cleared. WARNING: As soon as possible, remove and clean all guns. CAUTION: Remove guns one at a time so that a base for realignment of cleaned guns is retained.

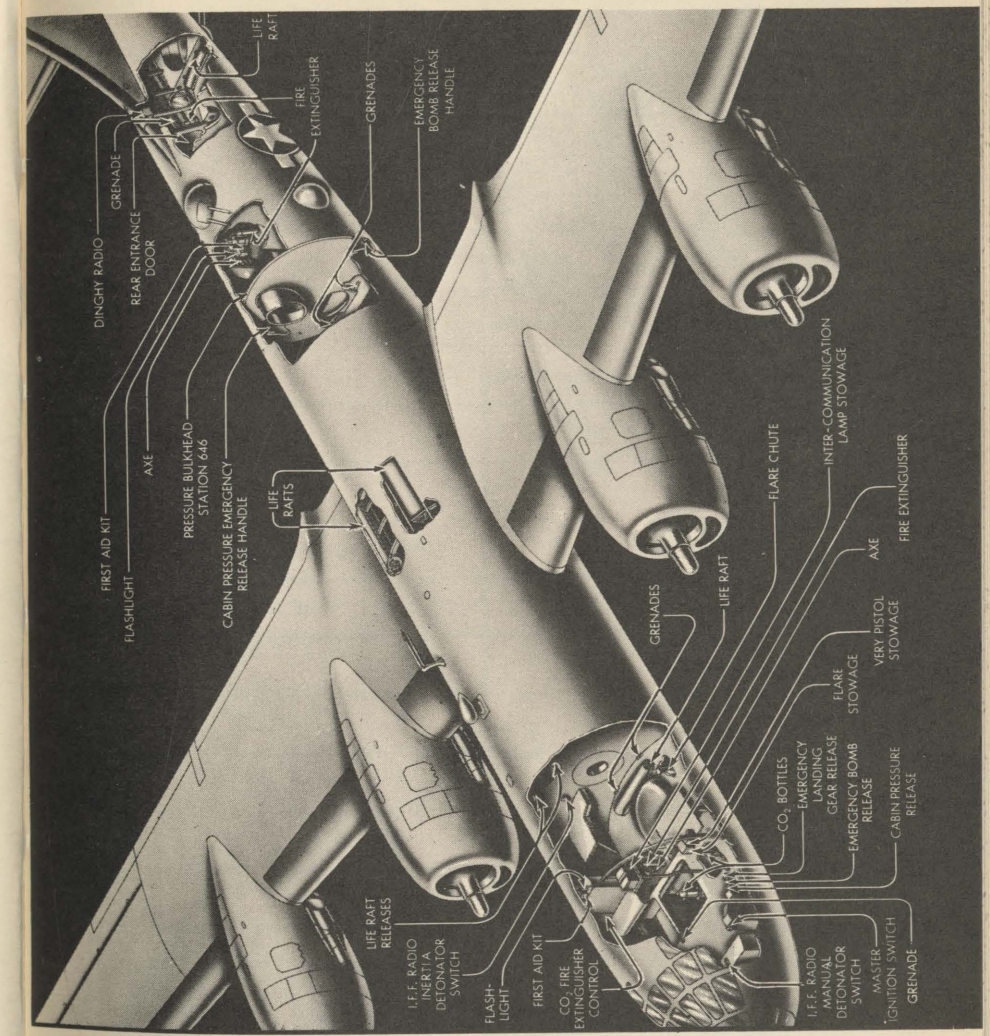
NOTES:

NOTES:

Section 3

EMERGENCY PROCEDURES



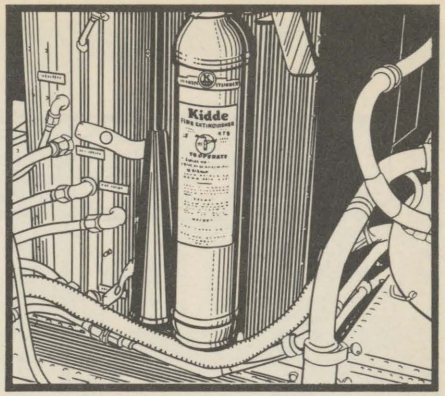


EMERGENCY EQUIPMENT

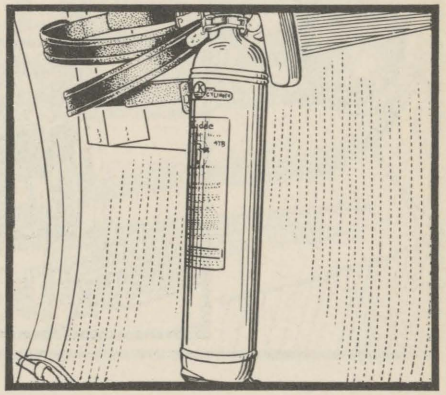
NOTES:

HAND FIRE EXTINGUISHERS

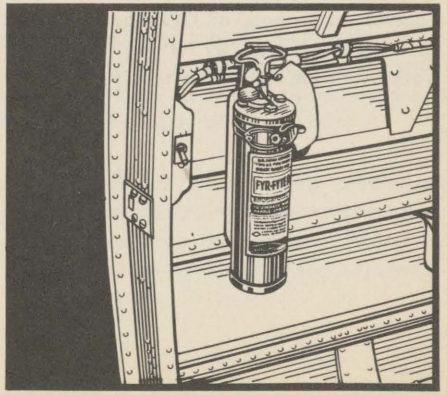
There are three hand-type fire extinguishers in each airplane.



One CO_2 type fire extinguisher is located on the inboard side of the flight engineer's control stand.

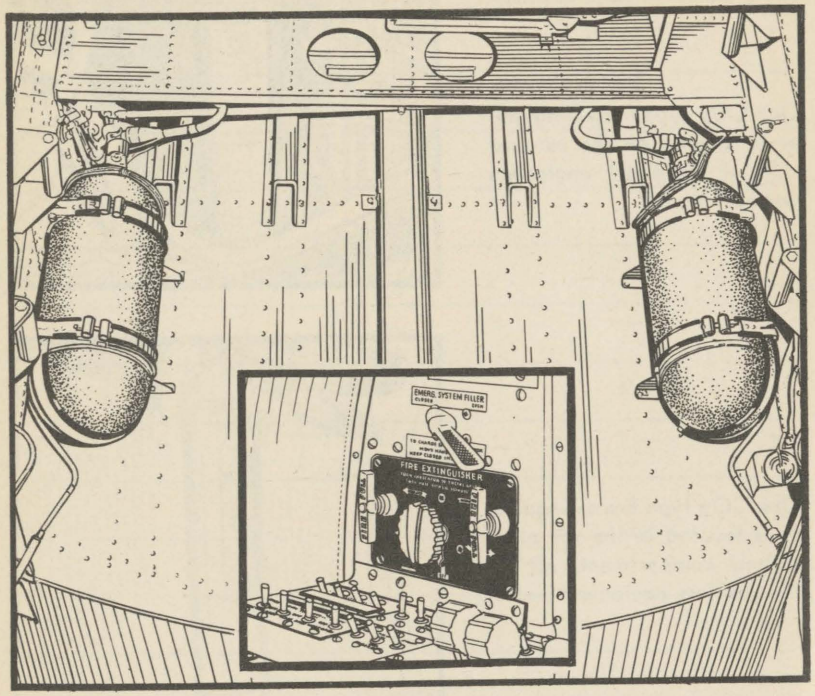


One CO_2 type fire extinguisher is located in the aft pressurized compartment, aft of the auxiliary equipment panel.



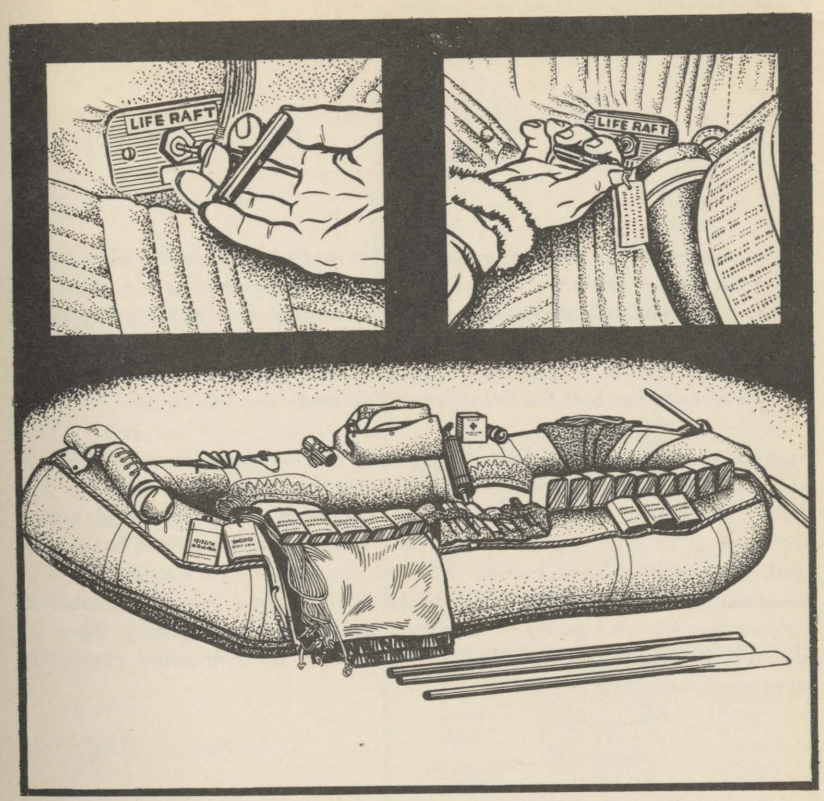
One carbon tetrachloride (Pyrene) type fire extinguisher is stowed beside the rear entrance door.

ENGINE FIRE EXTINGUISHERS



Engine fire extinguisher controls are on the engineer's panel. These handles control the release of CO_2 gas from two high-pressure steel bottles in the forward wheel well. By turning the selector handles, the contents of either or both bottles may be directed to any engine.

LIFE RAFTS



Four 5-man (1000 pound) life rafts are carried in the airplane.

Two completely equipped life rafts can be released by pulling handles in the forward pressurized compartment located on either side of the tunnel entrance. Inflation is automatic upon release. A flush type external release handle is provided for the release of the rafts from the outside of the airplane.

Two completely equipped life rafts are stowed, one in the forward pressurized compartment and one in the aft pressurized compartment. These rafts must be passed through the exits to crew members outside the airplane after it is ditched. They are inflated with CO_2 after they are taken out of the airplane.

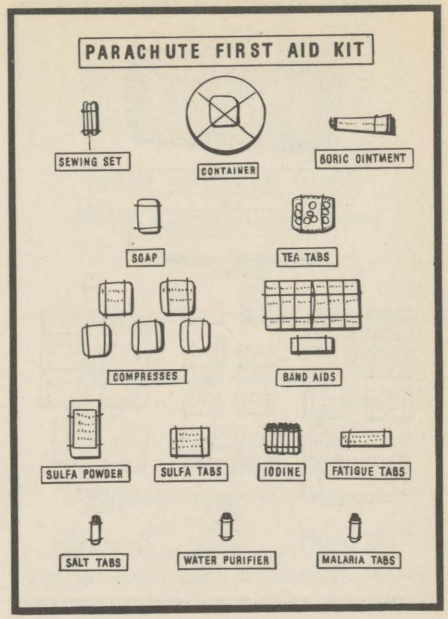
A complete supply of medical equipment has been placed in the airplane for the protection of the crew members. However, these supplies are of no use if they are removed from their containers before an emergency arises which requires their application. Therefore, DO NOT OPEN OR TAKE ANYTHING from any medical kit until the emergency occurs. The thoughtless breaking of this rule already has cost the lives of wounded men.

Apart from the individual first aid packets, medical supplies are carried in waterproof canvas cases which are fastened to the airplane by means of "lift-the-dot" fasteners. A flap on the case is fitted with metal rings which permit each type of kit to be snapped to the back straps of the parachute harness for facility in handling during bail-out from the airplane and for carrying while on the ground. IN CASE OF A FORCED LANDING, the various kits should be stowed near the emergency exits so they can be removed quickly. Upon attempting to return to civilization, the kits should be distributed among the crew members.

INDIVIDUAL EQUIPMENT

Parachute First Aid Kit:

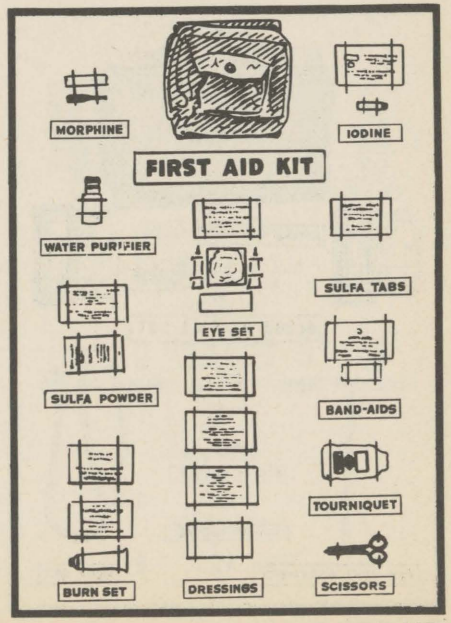
One of these kits is placed in each parachute pack. The plexiglas container is designed to fit into the frying pan. Directions for using each item of first aid equipment are fastened inside the top cover of the container.

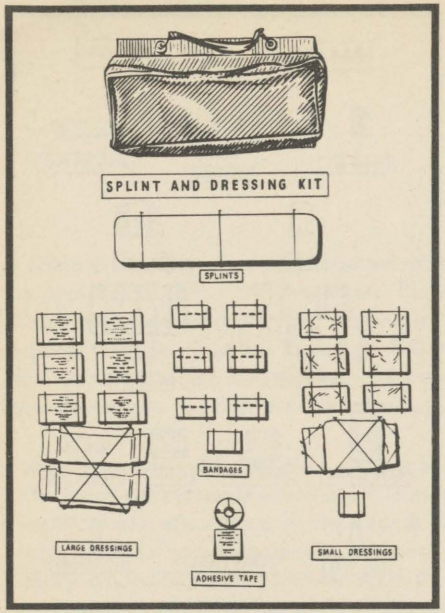


AIRCRAFT EQUIPMENT

Aeronautic First Aid Kit:

Five of these kits are carried: two in the forward pressurized compartment, two in the aft pressurized compartment and one in the tail gunner's compartment. The kits contain drugs and supplies for treating wounds and other injuries. Written directions are enclosed in each kit case.

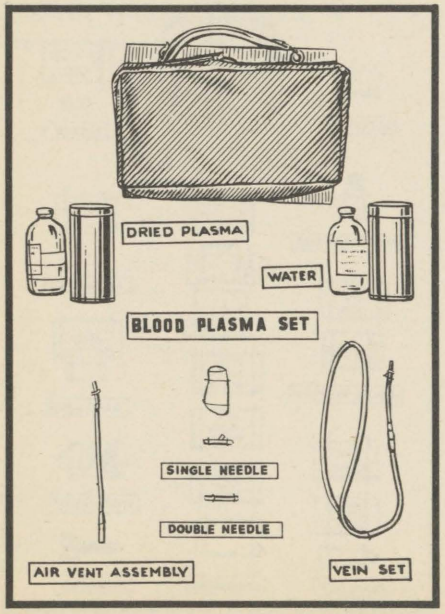




AIRCRAFT EQUIPMENT

Splint and Dressing Kit:

Two of these kits are carried: one in the forward pressurized compartment and one in the aft pressurized compartment. The kits contain dressings and wooden splints for the treatment of broken bones, large wounds, and average injuries. Written directions are enclosed in each kit case.



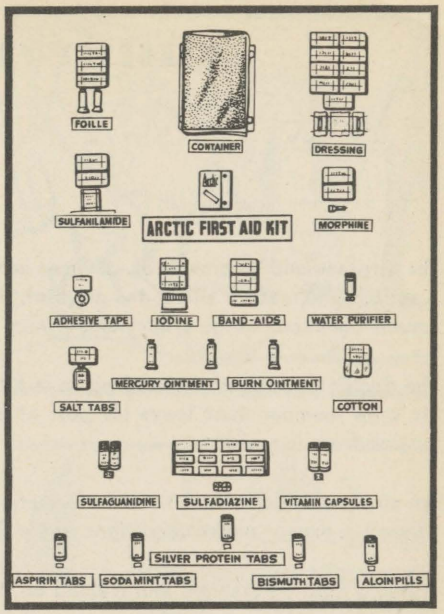
Blood Plasma Kit:

Two of these kits are carried: one in the forward pressurized compartment and one in the aft pressurized compartment. Each kit contains two blood plasma units. A unit consists of two sealed metal containers in which are placed all the items needed to prepare and administer the plasma. Plasma is given to men who are suffering from severe bleeding, bullet and shrapnel wounds, shock, and other serious injuries. Directions for using this equipment are printed on the containers.

AIRCRAFT EQUIPMENT

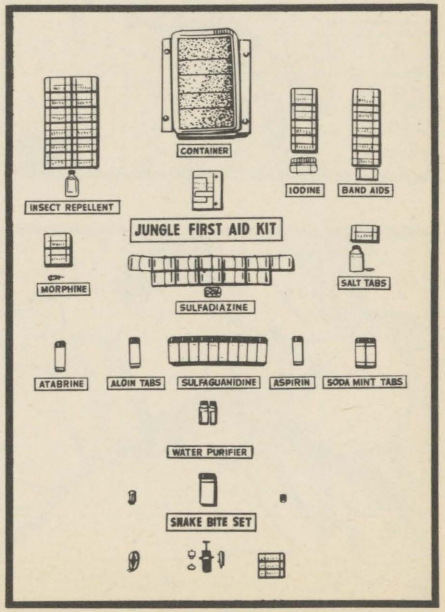
Arctic First Aid Kit:

One of these kits is carried in the forward pressurized compartment. The medicines and supplies in it are designed to prevent or cure illnesses peculiar to arctic regions which may be encountered while awaiting rescue, or while making your way back to civilization following a forced landing. Directions for using this equipment are printed on the inside cover of the container.



Jungle First Aid Kit:

One of these kits is carried in the aft pressurized compartment. The medicines and supplies in it are designed for illnesses peculiar to the tropics which may be encountered while awaiting rescue or making your way back to civilization following a forced landing. Directions for using this equipment are printed on the inside cover of the container.



EMERGENCY PROCEDURES

The airplane and its crew is at all times under the command of the pilot. If he is seriously injured or killed, the co-pilot, flight engineer, and bombardier will assume command in the order named.

The decision to abandon the airplane in flight is at the discretion of the pilot. No crew member must leave his post at any time during flight without permission from the pilot.

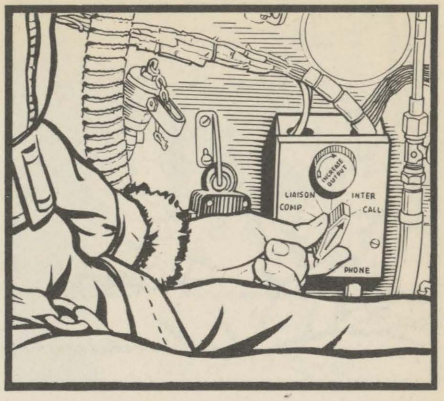
An airplane under attack while in formation must not leave its position in the formation except under conditions where flight cannot be maintained.

All guns must be manned and trained on the enemy even though the guns are jammed or out of commission.

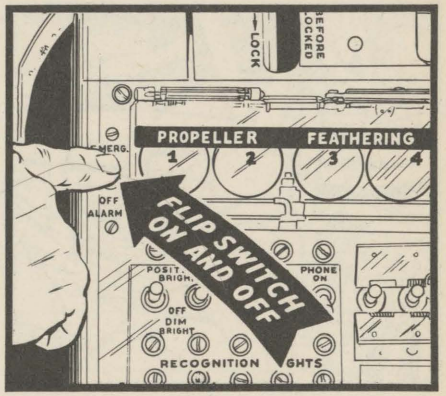
ALARM PROCEDURE

To be followed in an emergency

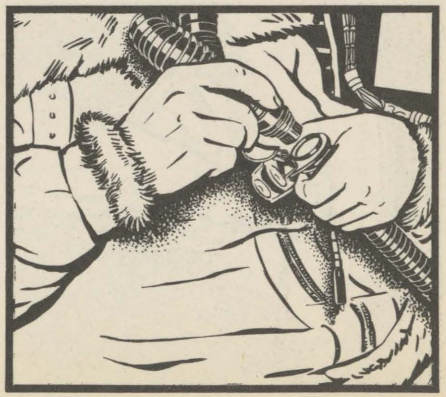
When an emergency is discovered, inform the pilot over the INTERPHONE.

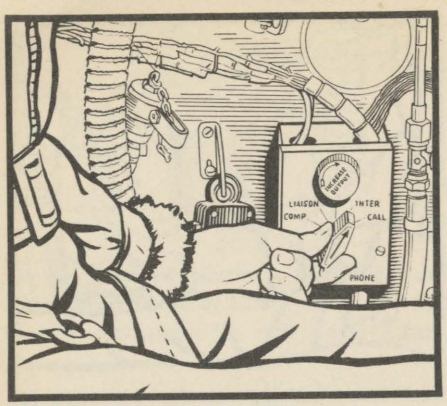


The pilot will signal to the crew to prepare for emergency. The signal is a series of short rings on the alarm bell.

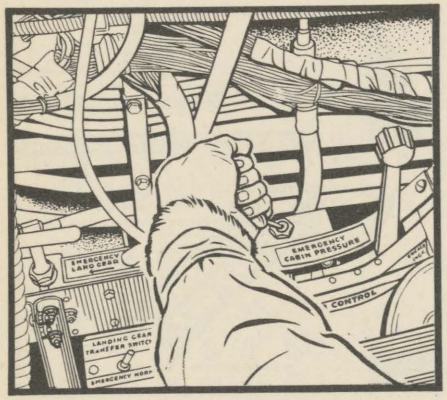


If the altitude at which the airplane is flying requires the use of oxygen, each crew member immediately must put on his oxygen mask and connect it to the airplane's oxygen system as soon as the emergency signal rings. See that your bail-out bottle hose is connected to your oxygen mask but do not turn it to the ON position until you receive the signal to "ABANDON SHIP."

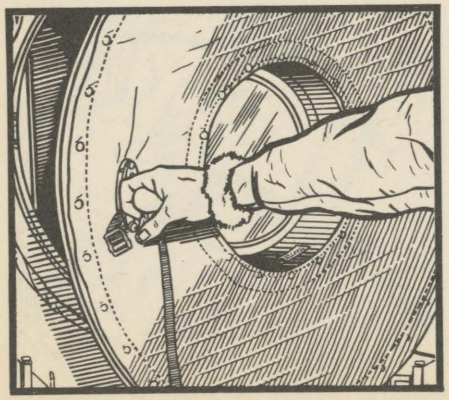




Each crew member will switch his JACK BOX SELECTOR switch to INTER. (interphone), and will adjust his parachute and check his other emergency gear.

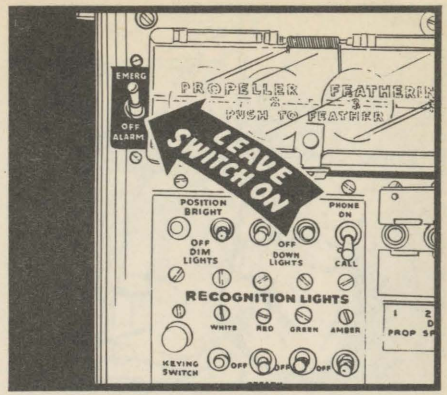


To relieve the cabin air pressure, the pilot will pull the EMERGENCY PRESSURE RELEASE handle.

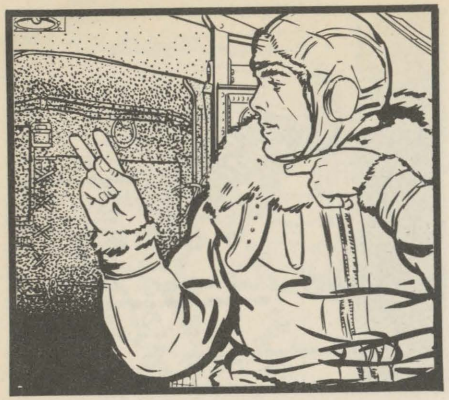


In the event of failure of the ALARM BELL or INTERPHONE, the pilot will order all pressure doors to be opened to permit visual and oral communication.

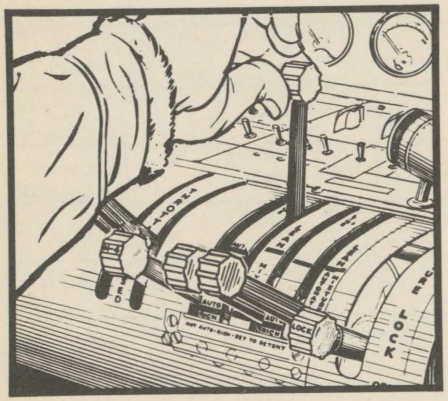
A CONTINUOUS RING on the ALARM BELL is the signal for all crew members to "ABANDON SHIP."



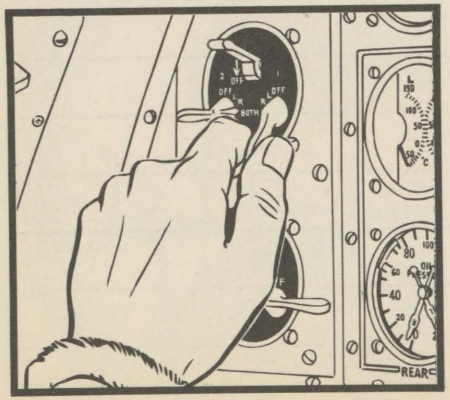
NOTES:



The pilot will order the FLIGHT ENGINEER to stop the engine which is on fire.

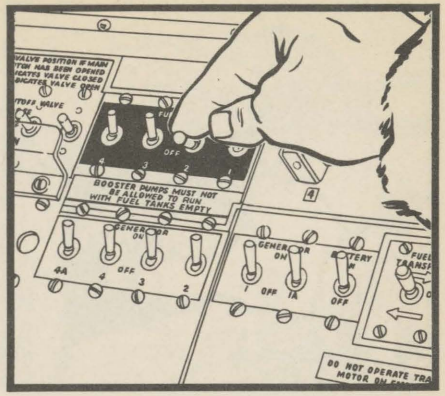


The flight engineer will pull the proper MIXTURE CONTROL handle to the IDLE CUT OFF position . . . .

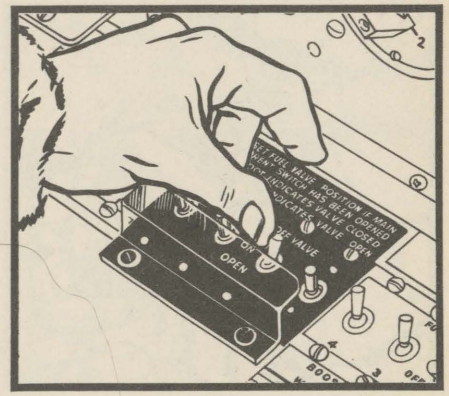


. . . . shut off all ignition switches . . . .

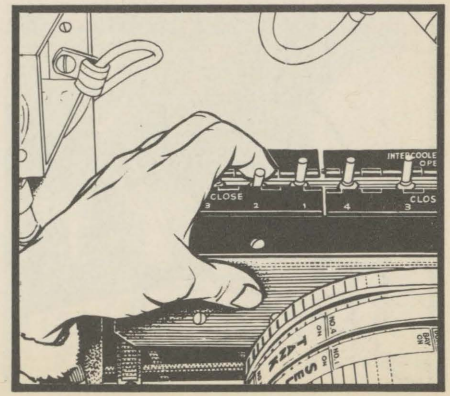
. . . .stop the booster pump . . . .

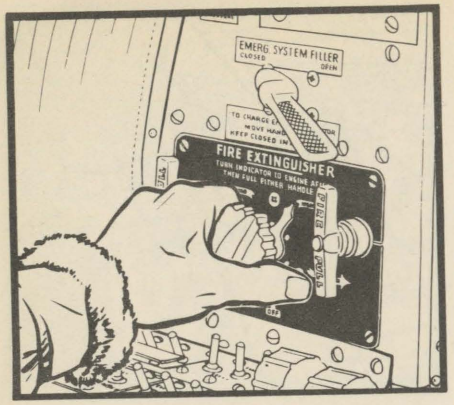


. . . . close the FUEL SHUT OFF VALVE . . . .

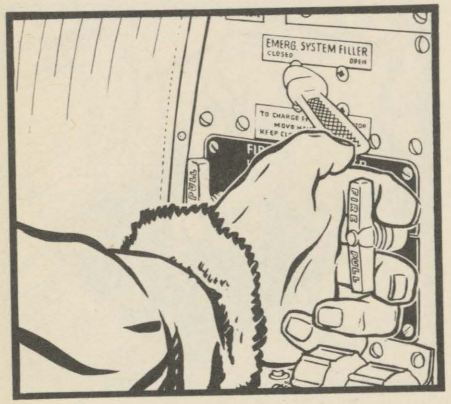


. . . . close the cowl flaps and . . . .

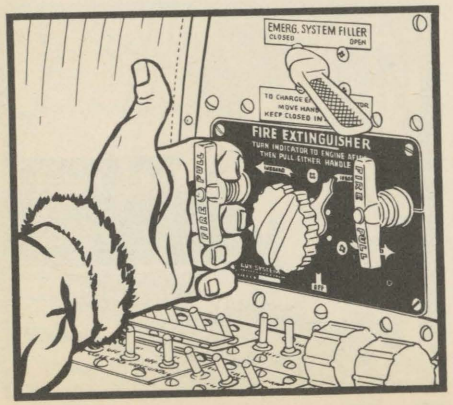




. . . . set the FIRE EXTINGUISHER SELECTOR valve which is connected to the burning engine.

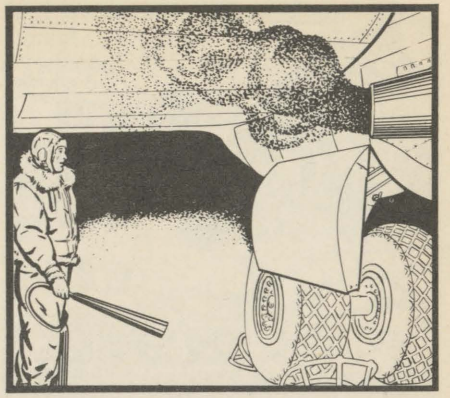


If the fire is not smothered when the COWL FLAPS are closed, the PILOT will order the FLIGHT ENGINEER to pull the proper handle to discharge the contents of one CO_2 bottle into the nacelle.

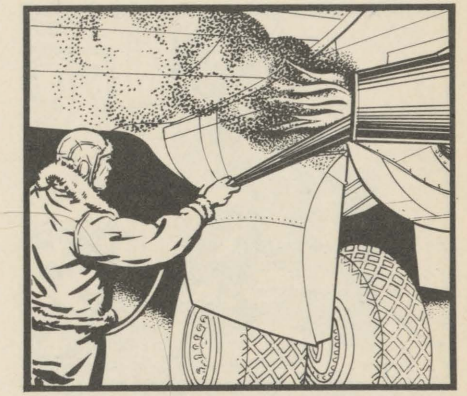


The flight engineer will discharge the contents of the second CO_2 bottle into the nacelle when so ordered by the pilot.

The GROUND FIRE EXTINGUISHER should be used only as a last resort if the engine is warm. The extinguishing material may crack overheated metal and cause considerable damage.

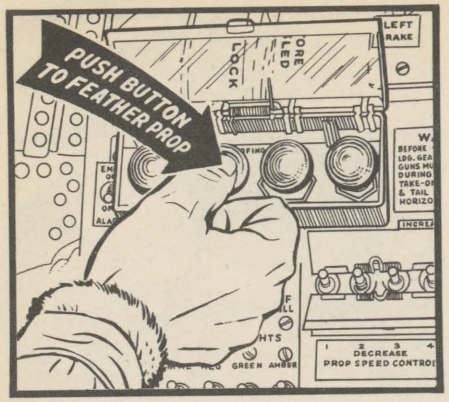


If the fire is not brought under control after the discharge of the second CO_2 bottle, the PILOT will signal the ground crew to apply the ground fire extinguishers to the fire.

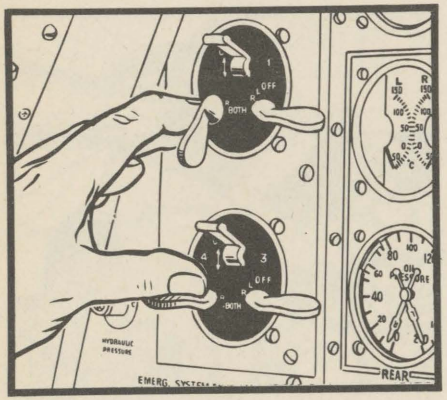


If the fire is in engines number 3 or 4, the CO-PILOT will report the progress of the fire to the pilot.

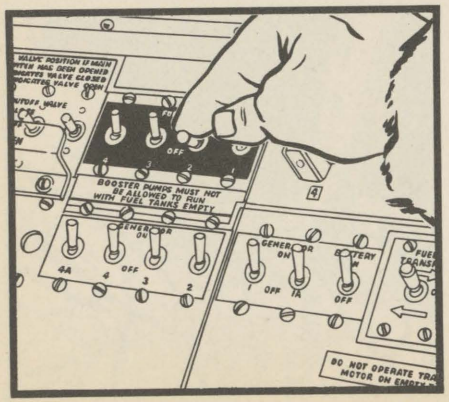




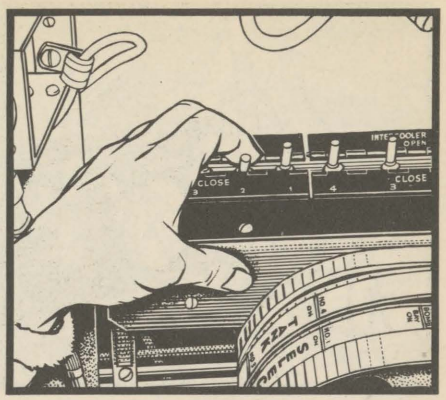
The pilot will order the flight engineer to stop the engine which is on fire, and will FEATHER the PROPELLER.



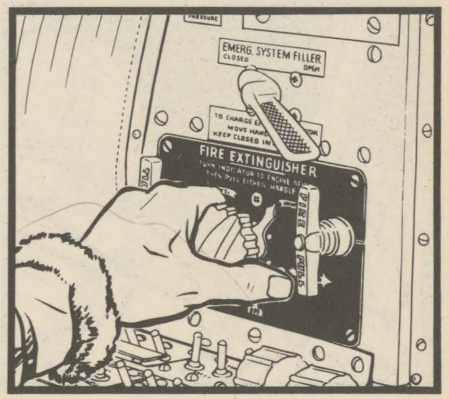
The flight engineer will turn the ignition switch to the OFF position . . . .



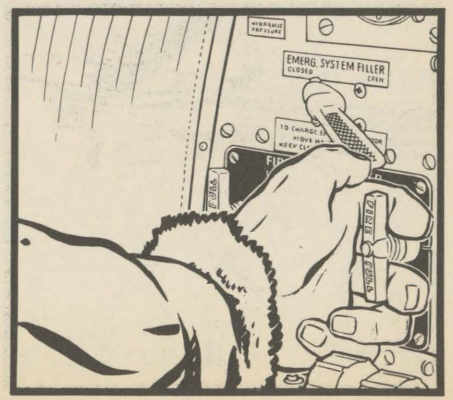
. . . . stop the flow of FUEL to the burning engine . . . . .



. . . . close the COWL FLAPS and . . . .

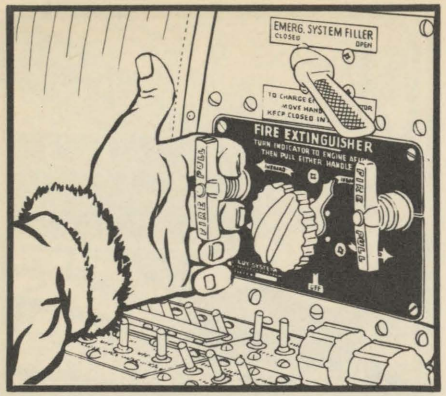


. . . . set the FIRE EXTINGUISHER SELECTOR valve connected to the burning engine.

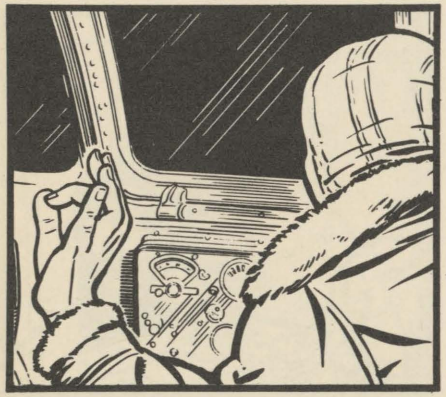


If the fire is not smothered when the COWL FLAPS are closed, the PILOT will order the FLIGHT ENGINEER to pull the proper handle to discharge the contents of one CO_2 bottle into the nacelle.

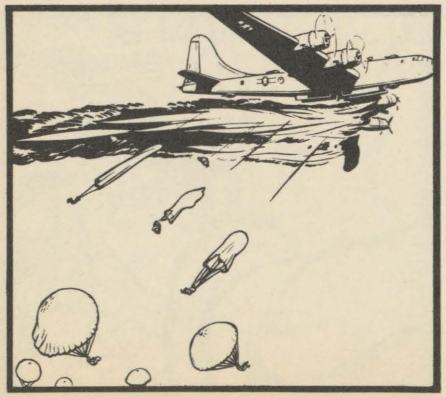
NACELLE FIRE DURING FLIGHT



When so ordered by the pilot, the flight engineer will release the contents of the second CO_2 bottle. (When fire occurs in more than one engine, do not attempt to distribute a single charge.)



If the fire is in engines number 3 or 4, the CO-PILOT will report the progress of the fire to the pilot.

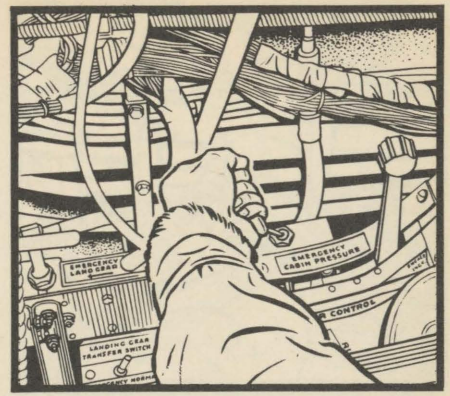


Fuel tank fires are extremely dangerous. When such a fire occurs, pilot will order the crew to prepare to abandon ship without delay. If the fire cannot be controlled, the order will be given to "ABANDON SHIP." The ALARM BELL will be turned ON and left ON.

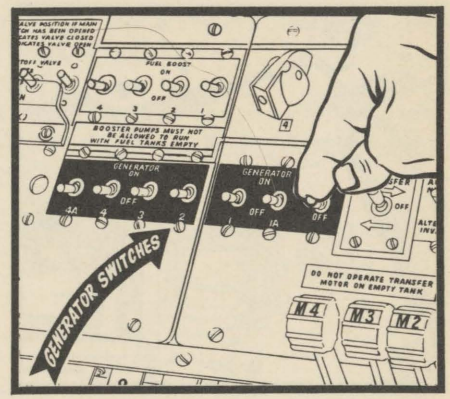
FIRE DURING FLIGHT

(ELECTRICAL FIRES)

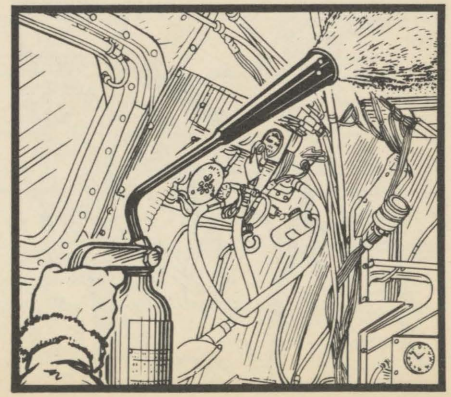
Discovery of the fire will be reported to the pilot who will immediately pull the EMERGENCY PRESSURE RELIEF valve handle.



The flight engineer will turn off all the electrical power with the BATTERY CONTROL and GENERATOR switches.

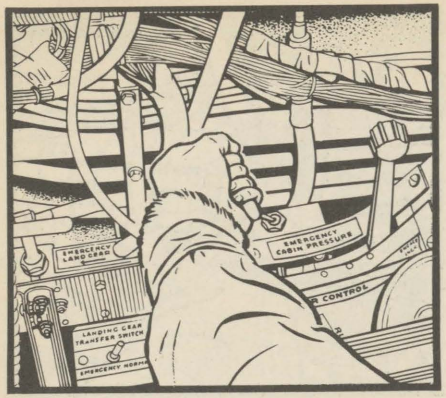


Crew members nearest the fire will use the portable extinguishers to control the fire. Use the carbon tetrachloride type extinguishers first, then the CO_2 type if necessary. WARNING: If the cabin interior becomes excessively smoky or gaseous after using the fire extinguishers open the BOMB BAY DOORS for ventilation.

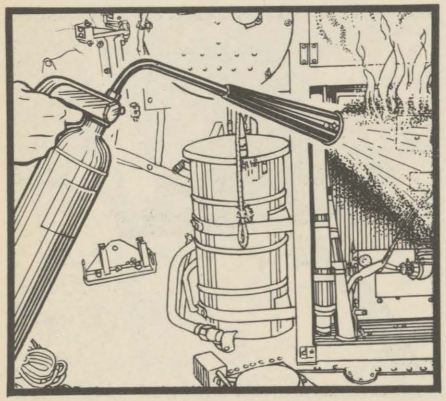


FIRE DURING FLIGHT

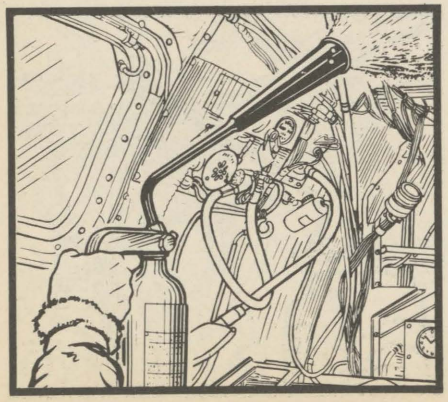
(CABIN INTERIOR FIRES)



Discovery of a fire will be reported to the pilot who will immediately pull the EMERGENCY PRESSURE RELIEF valve handle.



Crew members nearest the fire will use their portable extinguishers to control the fire. First use the carbon tetrachloride type extinquishers, then the CO_2 type if necessary. All exit doors should remain closed unless the pilot gives the order to abandon ship.

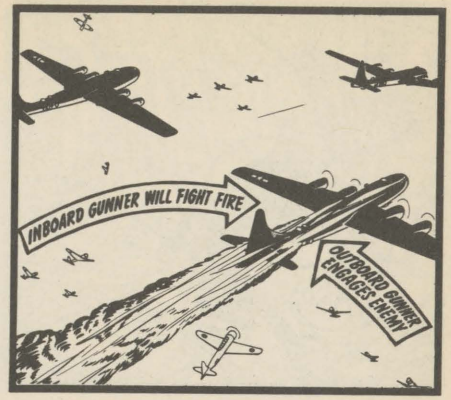


The navigator will operate the portable fire extinguisher which is stowed in the forward pressurized compartment.

FIRE DURING FLIGHT

(CABIN INTERIOR FIRES)

When the flight formation is under attack, the inboard side gunner (gunner nearest formation) will switch the control of his turrets to the outboard gunner and will operate the portable fire extinguishers which are stowed in the rear pressurized compartment. If the formation is not under attack, either side gunner may operate the fire extinguisher.

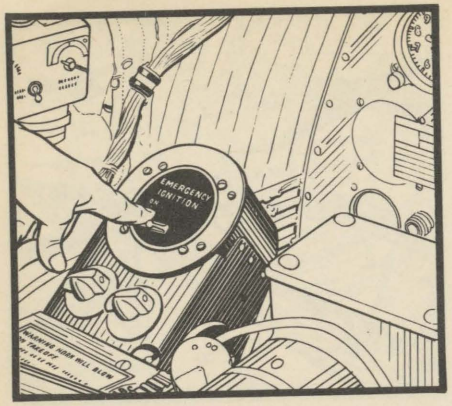


WARNING: USE EXTREME CAUTION WHEN APPROACHING FIRE WHEN THE OXYGEN SYSTEM IS IN OPERATION.

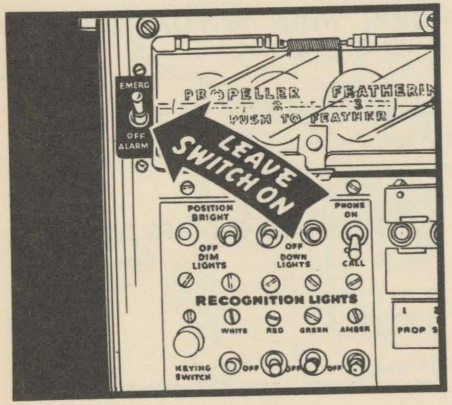
In all cases where the fire cannot be brought under control, the pilot will decide if and when it is necessary to abandon the airplane. It is sometimes possible to extinguish nacelle fires by diving or slipping the airplane.

DO NOT LEAVE THE AIRPLANE UNTIL YOU ARE ORDERED TO DO SO.

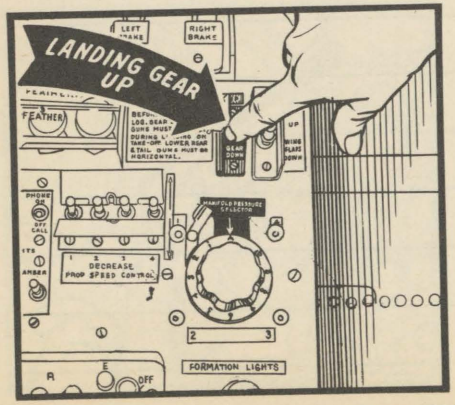
NOTES:



If two or more engines fail during the take-off, the pilot will immediately set the MASTER IGNITION switch to the OFF position. At the same time, the co-pilot will tell the flight engineer to prepare for a crash landing.

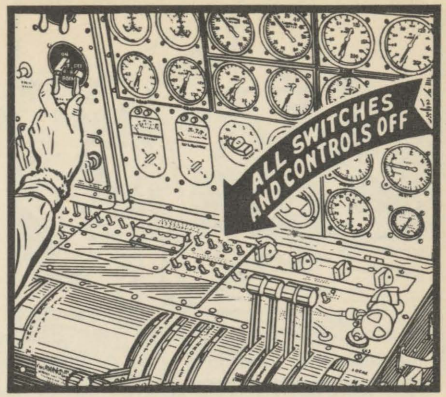


The pilot will set the ALARM BELL switch to the ON position and leave it there so the bell will ring continuously. At the same time . . . .



. . . . the pilot will set the LANDING GEAR switch to the UP position.

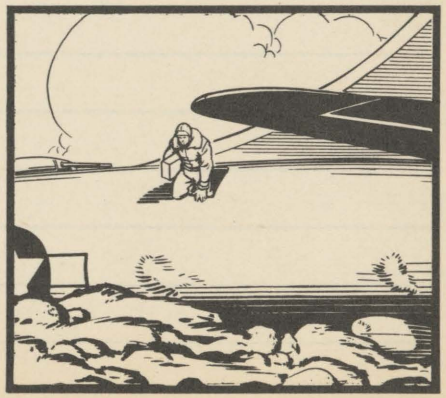
The flight engineer will set all switches to the OFF positions. NOTE: If the airplane is higher than 100 feet off the ground, do not shut the power off until the landing gear is retracted.



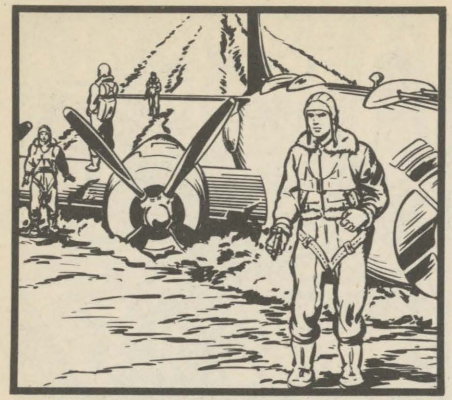
If there is not enough space to permit landing on the field, land OFF the field, STRAIGHT AHEAD.



After landing, leave the airplane. Take the FIRST AID KITS with you. Report any injuries to the pilot.



ENGINE FAILURE DURING TAKE-OFF



The pilot will see that all crew members are present and then post a guard around the airplane.

WARNINGS:

DO NOT FEATHER THE PROPELLERS.

DO NOT ATTEMPT TO TURN BACK TO THE FIELD.

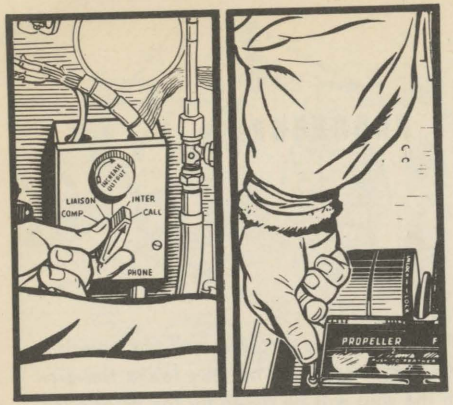
BE CAREFUL THAT ANY GASOLINE WHICH MIGHT HAVE BEEN SPILLED DOES NOT BECOME IGNITED.

NOTES:

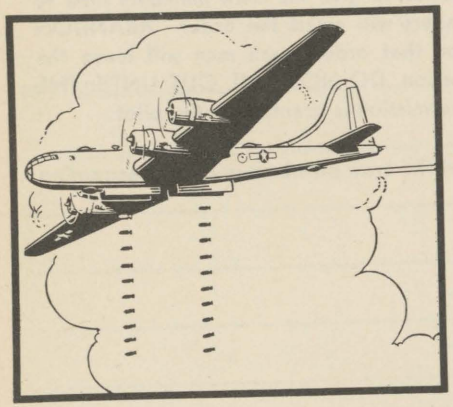
ABANDONMENT PROCEDURES

When the pilot decides it is necessary to abandon the airplane in flight, specific duties must be completed by each crew member before he may leave the airplane. A preparatory order to abandon the ship will be given by the pilot over the interphone usually enough in advance to give the crew members time to complete their duties. All crew members will await the order "ABANDON SHIP" before actually jumping Upon that order, each man will leave the airplane using the exit nearest his station. DO NOT BAIL OUT UNTIL THE ORDER IS GIVEN, unless individual permission is granted by the pilot.

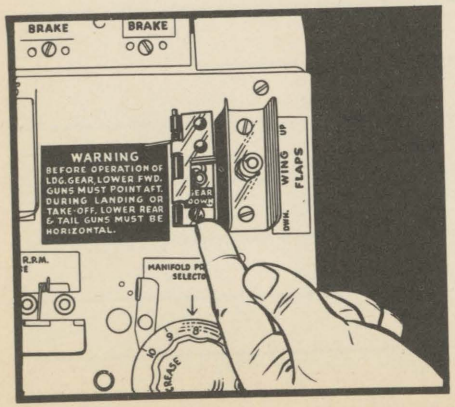
The sequence of the following duties of the crew members may vary according to the nature of the emergency.



Order the crew (over the interphone and by a series of short rings on the alarm bell) to "PREPARE TO BAIL OUT."



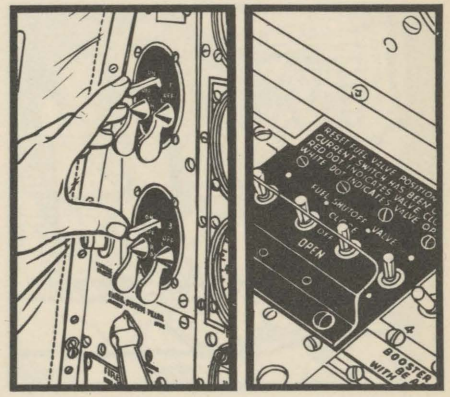
Order the bombardier to salvo the BOMB LOAD.



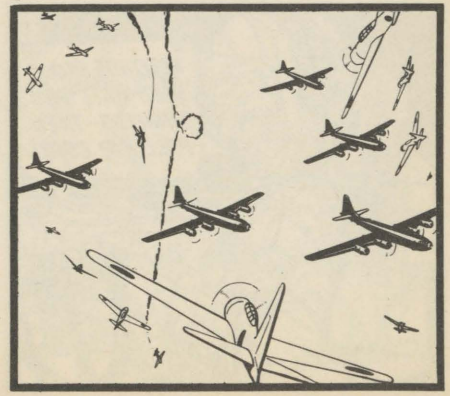
Lower the landing gear.



Order all of the airplane's RECORDS to be destroyed.



Order the flight engineer to turn all the IGNITION and FUEL switches to the OFF positions.



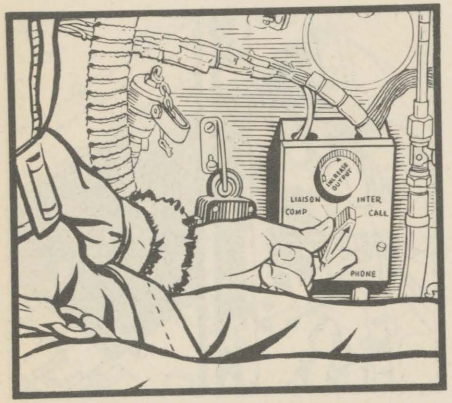
If under attack, maintain the airplane's position in the flight formation as long as possible.

ABANDONMENT PROCEDURES

PILOT



If not under attack, bring the airplane to a lower altitude to avoid the possible ill effects of high altitude bail-out.



Check with the crew (over the interphone) to see if any member is wounded. Order the navigator to assist the wounded men.



Tell the crew members at what altitude the airplane is flying and to "free fall" to a safe altitude before pulling the rip-cords of their parachutes.

ABANDONMENT PROCEDURES

CO-PILOT



Destroy all of the airplane's RECORDS that are in your possession.



Be ready to ASSUME COMMAND of the airplane and crew if the pilot is seriously injured or killed.



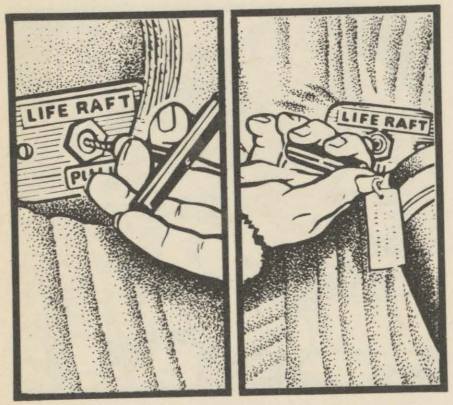
Help the navigator to prepare WOUNDED crew members for bail-out.

ABANDONMENT PROCEDURES

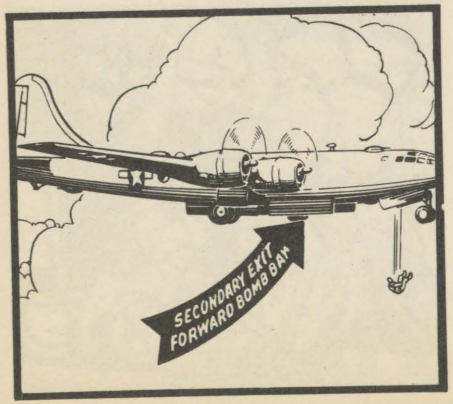
CO-PILOT



Report to the pilot when all of the crew members are ready to leave the airplane.



Release the LIFE RAFTS if the airplane is over water. Prepare to throw out the life raft which is stowed in the forward pressurized compartment.

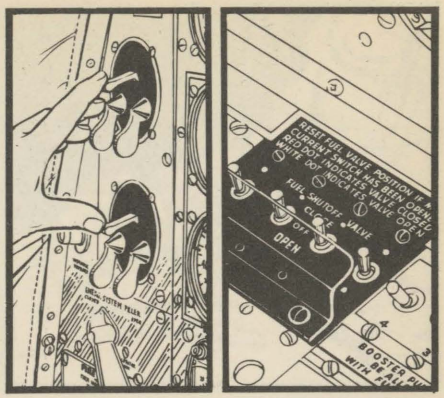


Upon signal (or order from the pilot) BAIL OUT through the NOSE WHEEL WELL. The forward bomb bay door may be used as a secondary exit.

ABANDONMENT PROCEDURES

FLIGHT ENGINEER

Upon order from the pilot, turn all the IGNITION and FUEL switches to the OFF position.



Be ready to ASSUME COMMAND of the airplane and its crew if the pilot and co-pilot are seriously injured or killed.



Help the co-pilot and navigator prepare the WOUNDED crew members for bail-out.

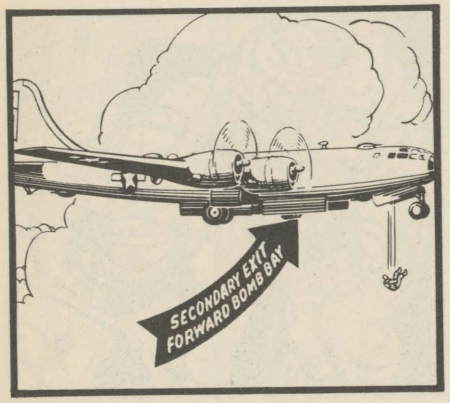


ABANDONMENT PROCEDURES

FLIGHT ENGINEER



Destroy all the airplane's RECORDS that are in your possession.



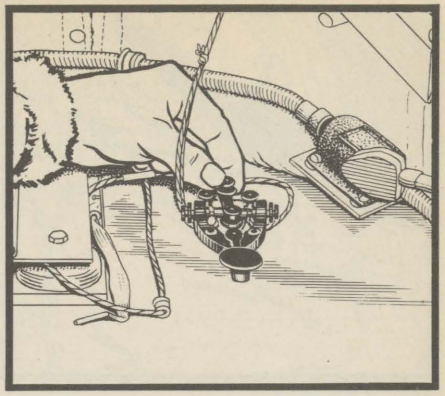
Upon signal (or order from the pilot) BAIL OUT through the NOSE WHEEL WELL. The forward bomb bay door may be used as a secondary exit.

NOTES:

ABANDONMENT PROCEDURES

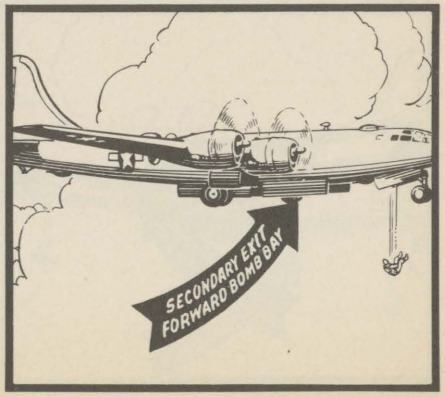
RADIO OPERATOR

BROADCAST the AIRPLANE'S POSITION. Fasten the transmitter key so that a continuous signal will be broadcast.





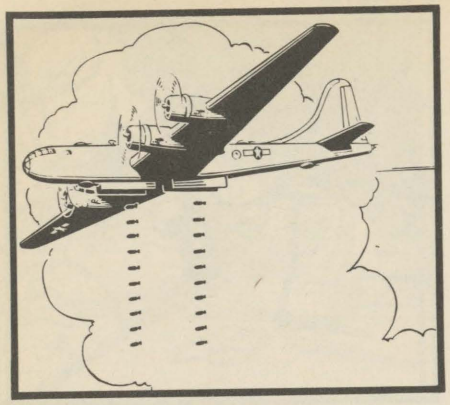
Help the co-pilot and navigator prepare WOUNDED crew members for bail-out.



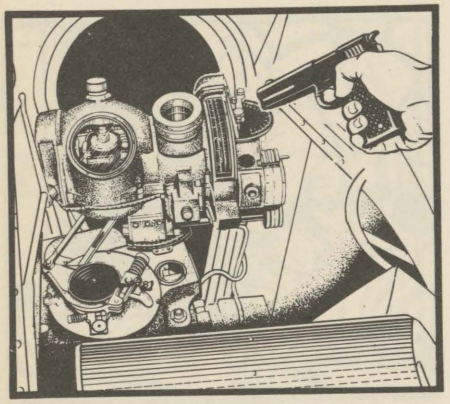
Upon signal (or order from the pilot) BAIL OUT through the NOSE WHEEL WELL. The forward bomb bay door may be used as a secondary exit.

ABANDONMENT PROCEDURES

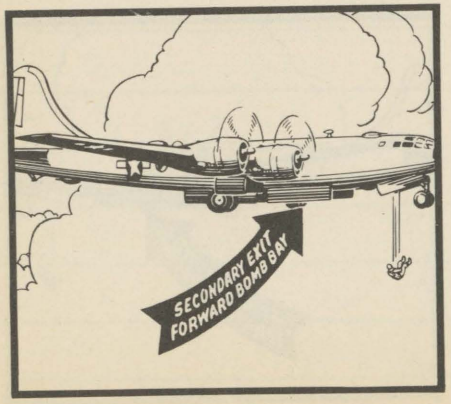
BOMBARDIER



Open the BOMB BAY DOORS and salvo the BOMB LOAD, upon order from the pilot. Leave the bomb bay doors OPEN.



Destroy the BOMB SIGHT with several shots from your service revolver. Destroy all the airplane's RECORDS that are in your possession.



Upon signal (or order from the pilot) BAIL OUT through the NOSE WHEEL WELL. The forward bomb bay door may be used as a secondary exit.

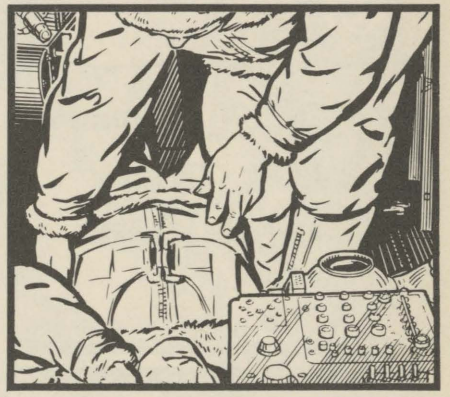
ABANDONMENT PROCEDURES

NAVIGATOR

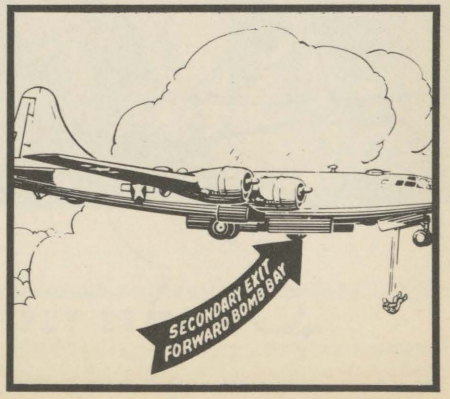
Determine the airplane's position, course, height and speed. Give this information to the pilot and the radio operator.



Help the WOUNDED crew members and prepare them for bail-out.



Upon signal (or order from the pilot) BAIL OUT through the NOSE WHEEL WELL. The forward bomb bay door may be used as a secondary exit.

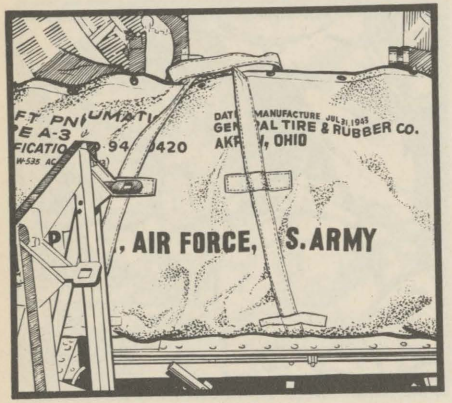


ABANDONMENT PROCEDURES

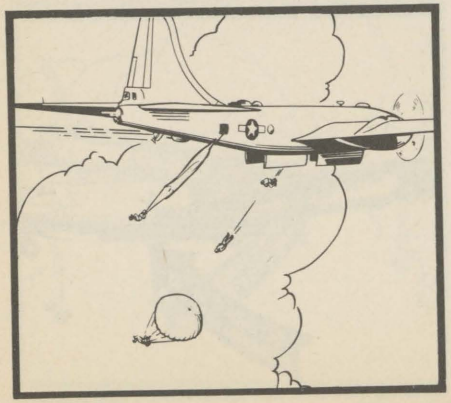
GUNNERS



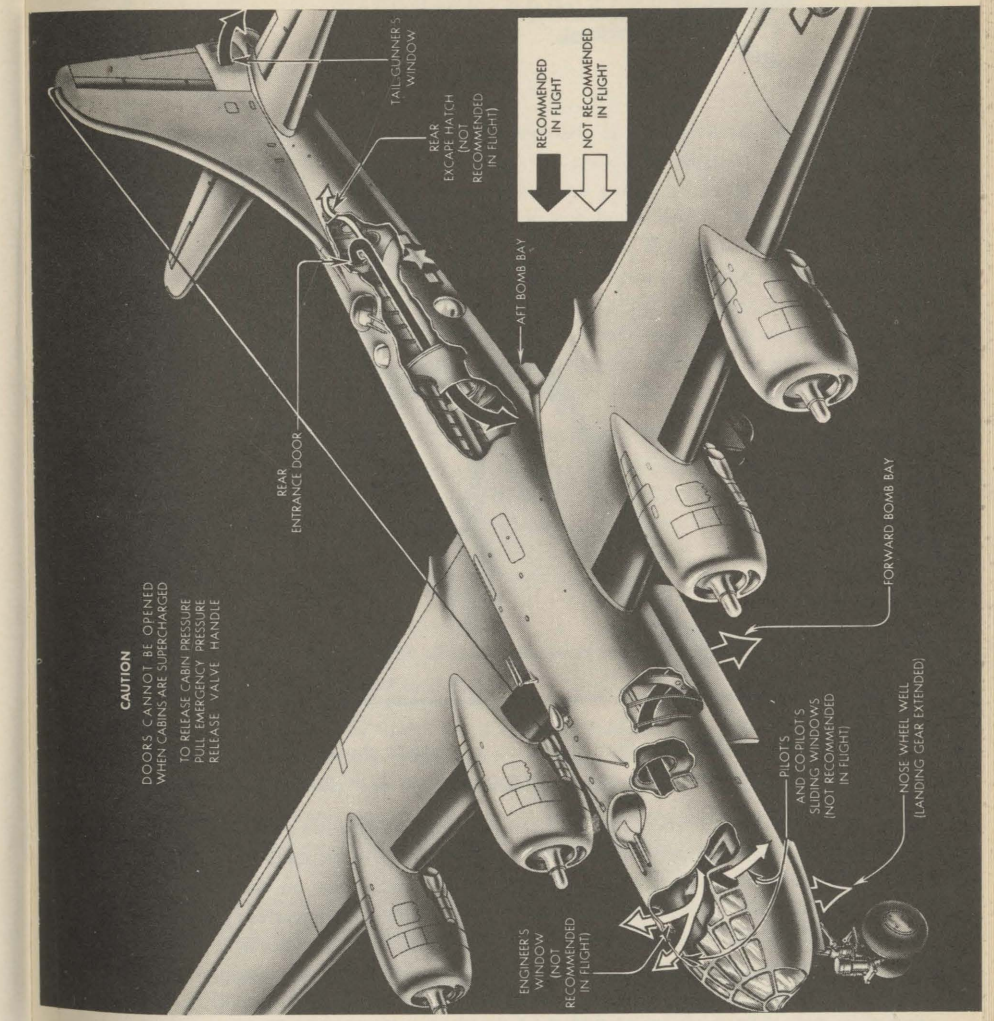
Destroy all the SIGHTS and COMPUTING MECHANISM.



If the emergency occurs over water, the top and side gunners will make sure that LIFE RAFT stowed in the unpressurized tail section is ready to be thrown out of the airplane.



Upon signal (or order from the pilot) the TAIL gunner will BAIL OUT through the REAR ENTRANCE DOOR and the TOP and SIDE gunners will BAIL OUT through the AFT BOMB BAY.



EMERGENCY EXITS

BAIL-OUT INSTRUCTIONS



Before bailing out of an airplane, each crew member should make sure that his bail-out bottle is in operation and is strapped securely in position.

If the bail-out is made while the airplane is flying at altitudes over 20,000 feet, "free fall" to a safe altitude and then pull the rip cord. An airplane at an altitude of 40,000 feet and an indicated airspeed of 100 mph, has an actual ground speed of 200 mph. To bail out and open the parachute immediately upon leaving the airplane under this condition will impose a force of deceleration upon the body which will cause unconsciousness. A free fall to approximately 10,000 feet will slow the rate of descent from the initial 270 mph at 40,000 feet, to approximately 120 mph at 10,000 feet. However, if at ANY TIME during the free fall, you feel that you are about to lose consciousness pull the rip cord. WARNING: The pilot's, co-pilot's, and flight engineer's escape windows are not to be used for bail-out because of the possibility of contact with the propellers. The emergency hatch above the auxiliary power plant is not to be used for bail-out because of the possibility of contact with the horizontal stabilizer.

DITCHING PROCEDURE

When forced descent (ditching) of the airplane is necessitated while flying out of the range of land, the pilot will warn the crew members to "PREPARE TO DITCH", and try to allow enough time for the preparation of the emergency equipment. The pilot will make sure that enough fuel is left in the tanks to permit a water landing with the airplane under full power. The value of power during ditching is so great that the pilot should always try to ditch the airplane before the fuel is exhausted. If the engines are not operating properly, a normal glide approach should be made to insure that control of the airplane will be retained and some margin of speed will be available after levelling off to allow the pilot to choose the most advantageous point on the water to make contact.

In a steep SWELL, the pilot should ditch ALONG THE TOP of the swell. In a long (shallow) ocean SWELL, he should ditch UP WIND. If ditching along the swell would involve alighting with a STRONG CROSS WIND (over 30 mph) the airplane should be ditched INTO THE WIND.

In ditching across a swell, the airplane should be put down on an upslope towards the top.

After flattening out, the pilot should endeavor to keep the airplane from striking the water until all excess speed is lost.

If the airplane alights tail down, (as it should) there will be a slight impact as the rear strikes, followed by a more severe impact with violent deceleration. In a moderate, or calm sea, the airplane will have a tendency to bounce if alighting is too rapid; when this occurs, the control column should be held back hard. In the average short sea, the tail should touch the crest of a wave and the nose should be kept up. This will cause the forward part of the airplane to touch on the next wave crest approximately under its center of gravity. The nose of the airplane will bury itself under the water but the structure will not collapse.

At night when there is bright moonlight, the airplane should be ditched toward the moon if the direction of the approach is not fixed by the wind or condition of the water.

WIND DIRECTION:

WAVES always move downwind, except when they are close inshore, and in fast-flowing estuaries. The line of wind can be taken to be at right angles to the lines of the wave crests. When there is sufficient wind, waves break downwind. When the airplane is flown at right angles to the breaking waves, the direction of the drift will be apparent. When there is enough wind to blow the spray off the wave crests, the direction to which the spray moves is a reliable index.

SWELL is a rising and falling movement of the sea surface caused by past or distant disturbances, or action of the wind. A SWELL DOES NOT ALWAYS MOVE WITH THE WIND and has no breaking crests. When the wind blows across the swell, a cross sea is created with the waves (which are moving downwind) running on the swell. In these conditions, the pilot must choose the direction along the swell which will make the approach as near as possible INTO THE WIND.

SMOKE rising from a ship's funnels always drifts with the wind. Do not assume that the trail of the smoke is the wind direction. The trail is the result of the wind speed and direction, and the ship's forward motion. Therefore, the wind direction is somewhere between the forward path of the ship and the smoke trail.

WIND LANES are alternating strips of light and shade which appear on the surface of the sea. They are reliable indications of surface wind direction.

WIND SPEED:

The degree of roughness of the sea indicates the velocity of the wind if it has been blowing in the same direction for any length of time.
In general, the indication is as follows:

A few white crests	10 to 20 miles per hour
Many white crests	20 to 30 miles per hour
Streaks of foam along the water	30 to 40 miles per hour
Spray from crests	40 to 50 miles per hour

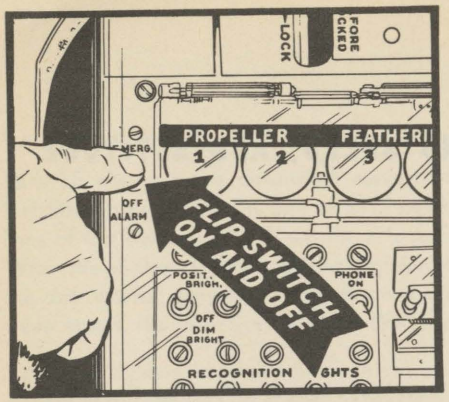
The wind is stronger than the appearance of the sea suggests during heavy rain storms, or if it is freshening, blowing off a nearby shore, or running with the tide or swell.

ALTITUDE

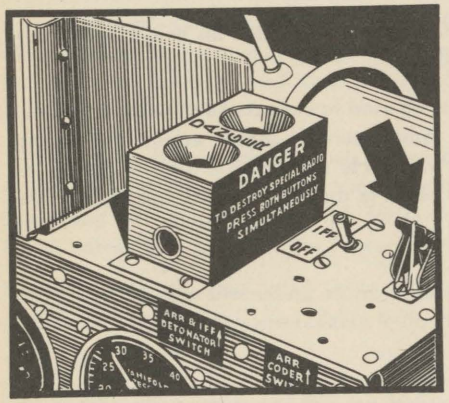
In a calm sea there may be little or no wind; consequently, ditch the airplane at the lowest possible indicated airspeed.

CAUTION: It is extremely difficult for the pilot to judge his height above the sea when the surface is smooth and glassy.

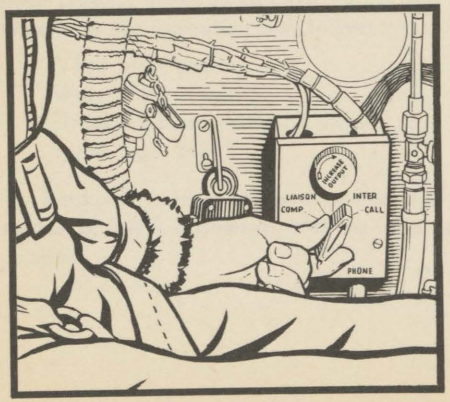
The ANEROID ALTIMETER should not be used to indicate height above the sea. If time and conditions permit, the radio operator should extend the trailing antenna and permit it to strike the water. He will notice a drop in current as soon as the antenna weight hits the sea. He may then inform the pilot of the approximate altitude.



The pilot will signal to all the crew members to "PREPARE TO DITCH" by a series of short rings on the ALARM BELL.

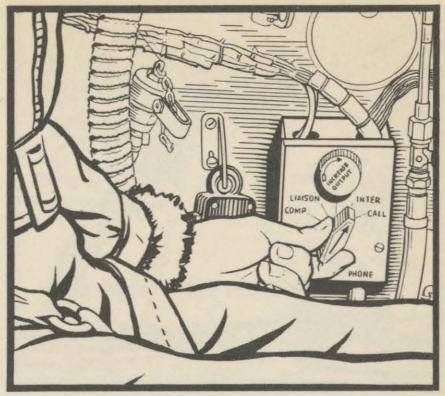


The pilot will set the IFF EMERGENCY switch to the ON position.

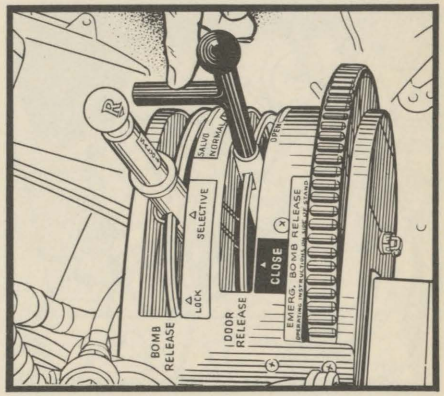


All crew members will set the selector switch on the jack boxes to INTER. (interphone) and wait for instructions from the pilot.

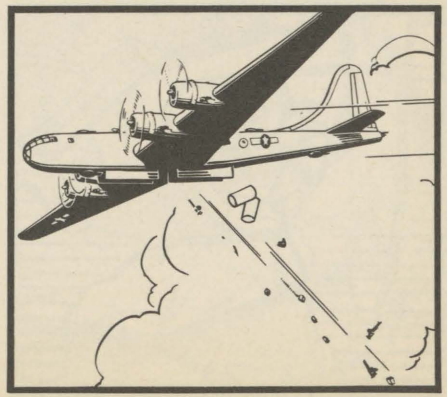
The pilot will inform the crew members of the approximate time the airplane will be ditched.

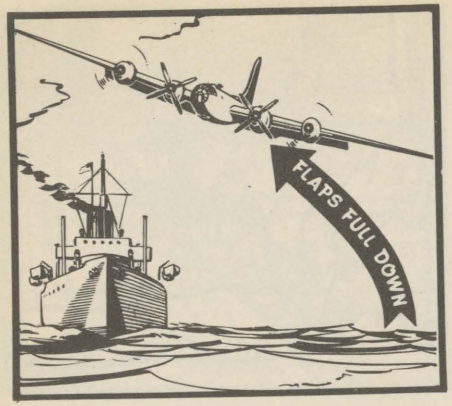


The bombardier will open the BOMB BAY DOORS.



The crew members will JETTISON all DISPOSABLE EQUIPMENT such as the bomb load, fuel not required to make the landing, guns and ammunition, cameras, etc. WARNING: All crew members except the tail gunner will jettison disposable equipment through the bomb bay doors.

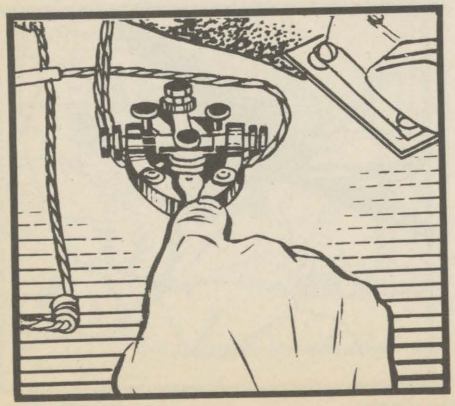




If possible, ditch the airplane near friendly surface craft.

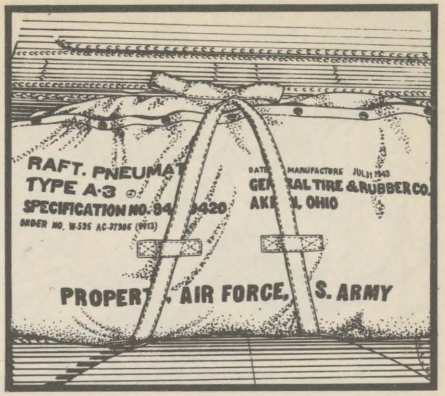


The navigator will DETERMINE the AIRPLANE'S POSITION and inform the pilot and radio operator.

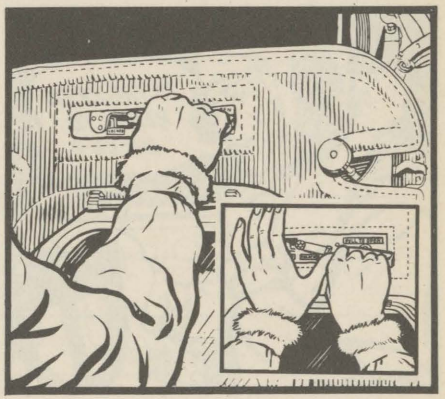


The radio operator will BROADCAST the airplane's position.

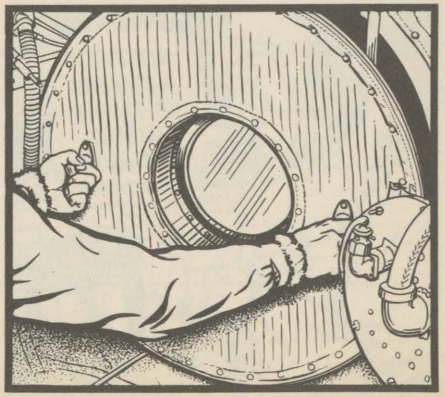
Crew members will place the LIFE RAFTS and other emergency equipment near the escape hatches.

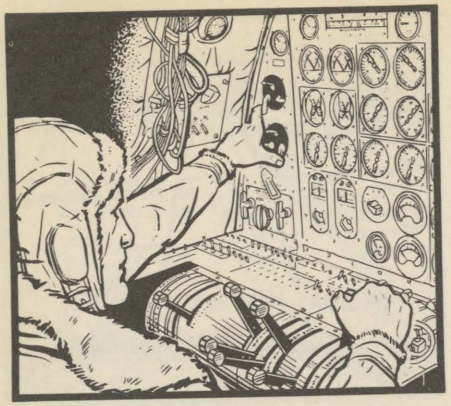


The pilot will order all escape hatches checked. The crew members will OPEN their escape hatches and leave them OPENED.

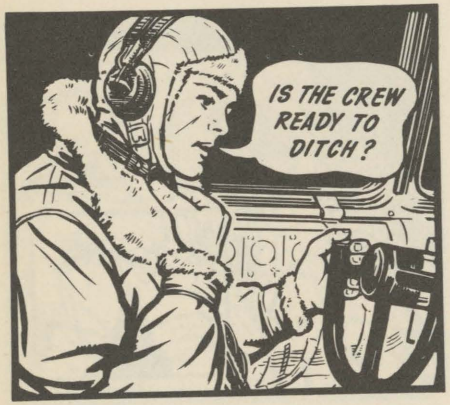


The pilot will order the bulkhead doors and bomb bay doors CLOSED.





The pilot will order the inboard engines stopped. DO NOT FEATHER THE PROPELLERS.

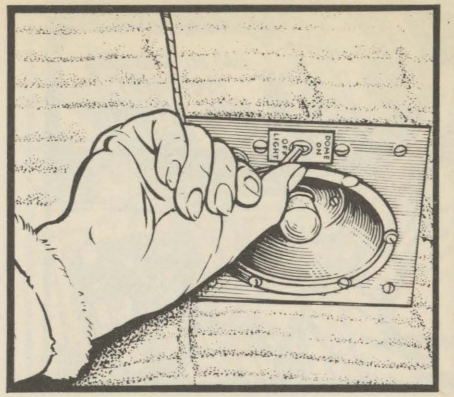


The pilot will check with each crew member to make sure that he is ready to ditch.



The pilot will order the crew members to their ditching stations.

- If the airplane is to be ditched at night, all bright lights will be turned off and the amber lights used. This permits the crew members' eyes to become accustomed to the darkness.

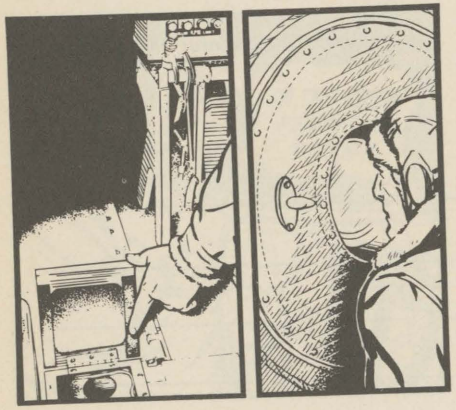


The crew members should remove and unfasten their winter flying boots their parachute harnesses.

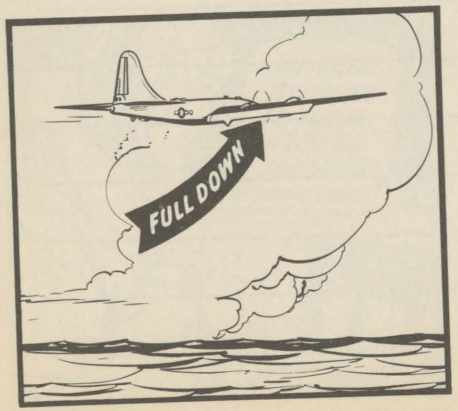
NOTES:



Put on your shoulder safety harness.
Check with the crew members to see that all disposable equipment has been jettisoned.



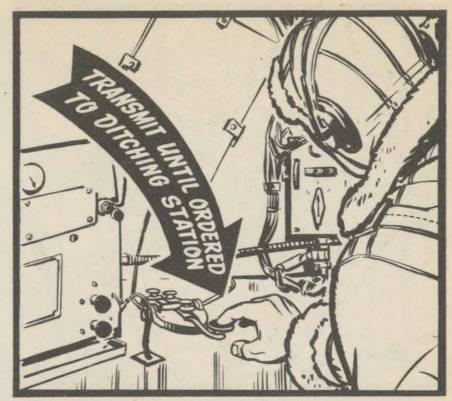
Check and see that the LANDING GEAR DOORS and BOMB BAY DOORS are CLOSED.



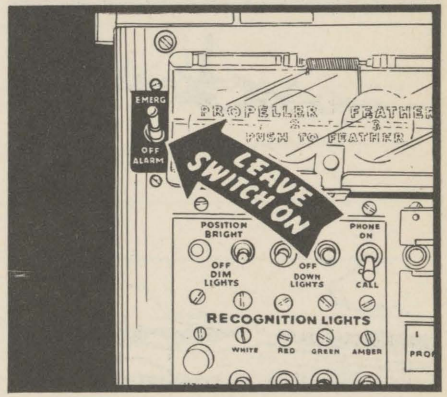
Lower the flaps to the full down position.

Check to make sure that your shoulder safety harness is properly adjusted.

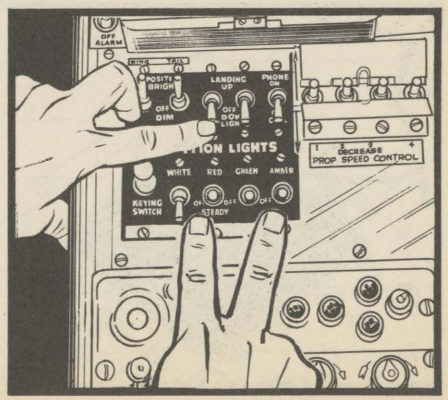
Order the radio operator to his ditching station. (He will broadcast the ship's position until ordered to his ditching station.)

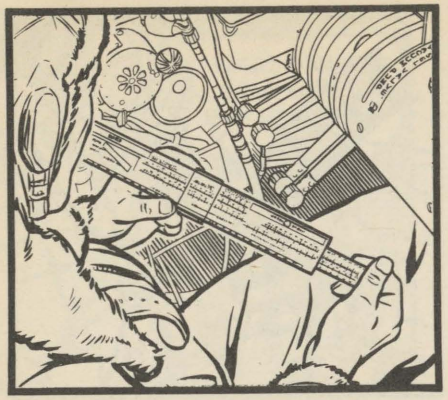


Warn the crew when the airplane is about to make contact with the water. Set the ALARM BELL switch so that the bell rings continuously.

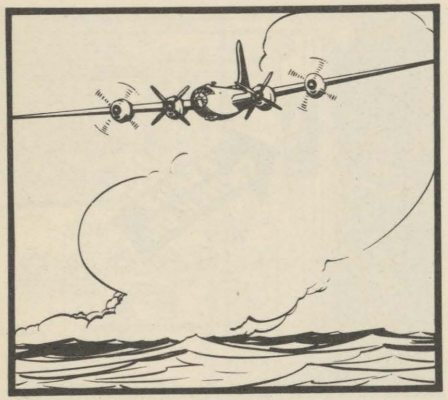


When the airplane is to be ditched at night, switch the LANDING LIGHTS and UPPER IDENTIFICATION LIGHT to the ON positions.

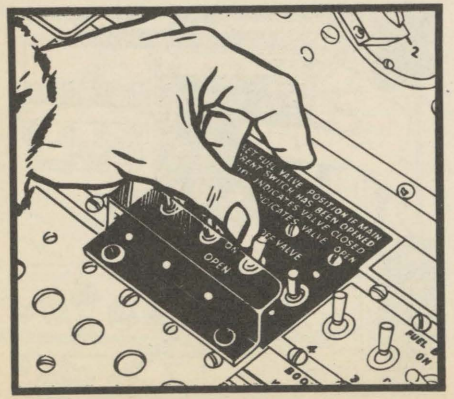




Compute the position of the center of gravity and inform the pilot. Order the AUXILIARY POWER PLANT started.



STOP the INBOARD engines when so ordered by the pilot.

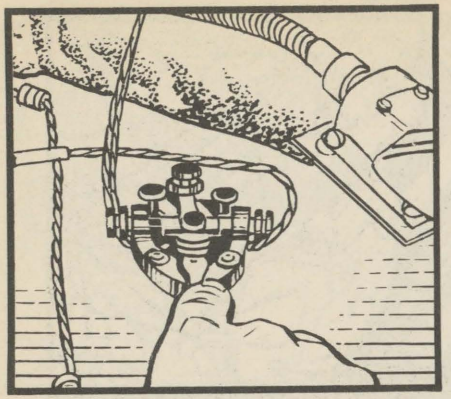


Turn all the FUEL VALVES to the OFF position when so ordered by the pilot.

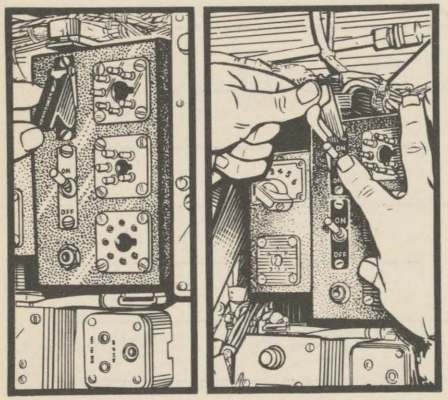
Assume your ditching position when ordered by the pilot to "BRACE FOR DITCHING."



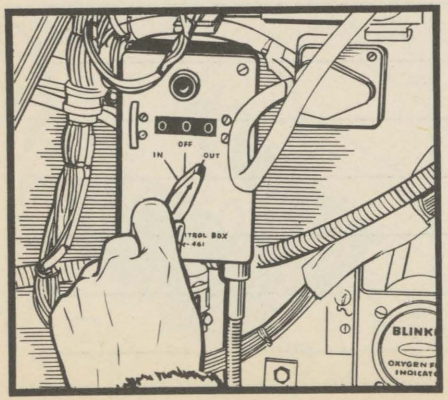
NOTES:



Transmit the SOS signal, giving the airplane's position, course, height, speed maintained, and approximate time it will be ditched.

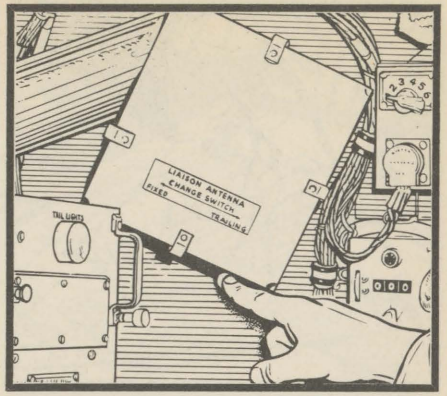


Set the IFF EMERGENCY switch to the ON position.

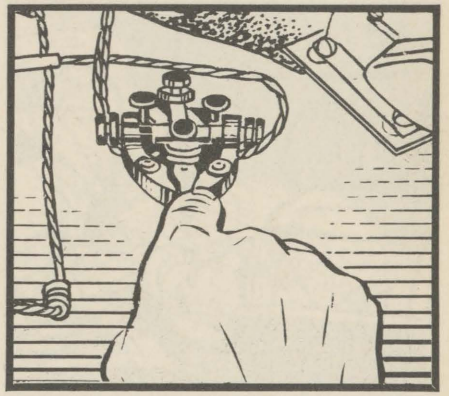


Release the TRAILING ANTENNA.

Turn the LIAISON ANTENNA switch to the TRAILING position.



Continue transmitting the navigator's estimated position until ordered by the pilot to go to your ditching station.



NOTES:

PREPARATION FOR DITCHING

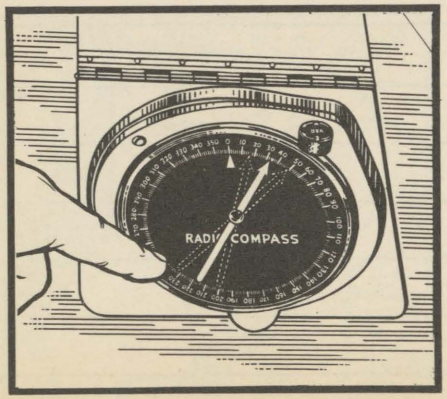
NAVIGATOR



The navigator should always know WS and D (wind speed and direction) DR (drift reading) and position.



Give the radio operator the DR, position, course, height, and speed maintained.

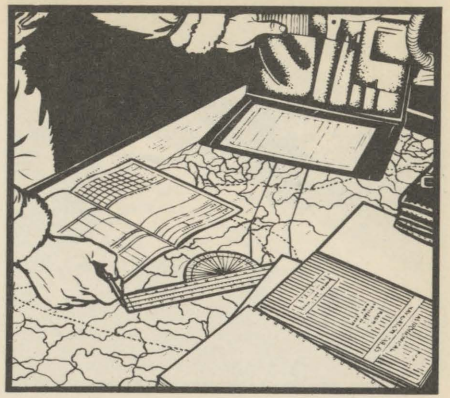


Get radio fixes and bearings from the radio operator.

PREPARATION FOR DITCHING

NAVIGATOR

Inform the pilot of the surface WS and D.

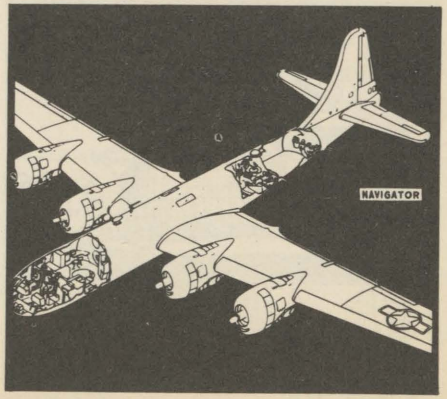


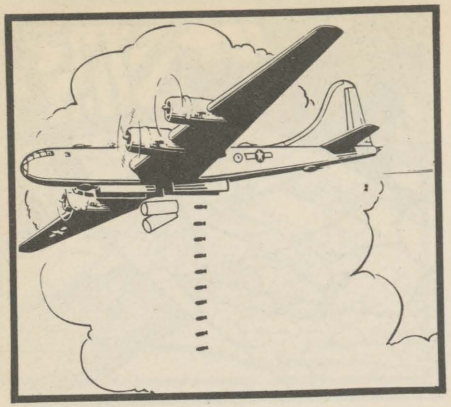
Destroy all secret papers. Have all charts and celestial navigation equipment ready to take with you when you leave the airplane.



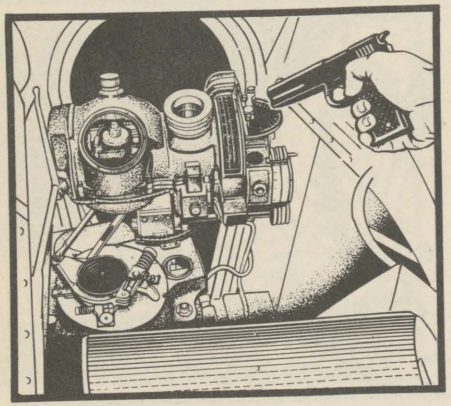
Go to your ditching station when ordered by the pilot.

SEE PAGE 377

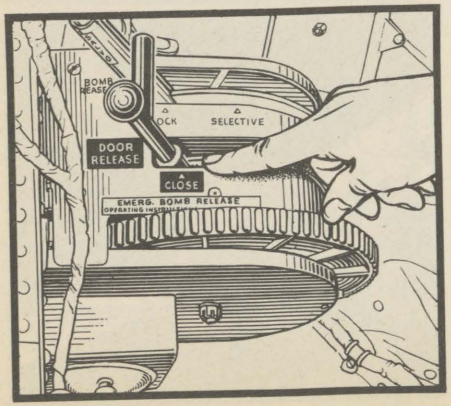




Open the BOMB BAY DOORS and salvo all BOMBS. Jettison the auxiliary fuel tanks if they are more than half full of gasoline.



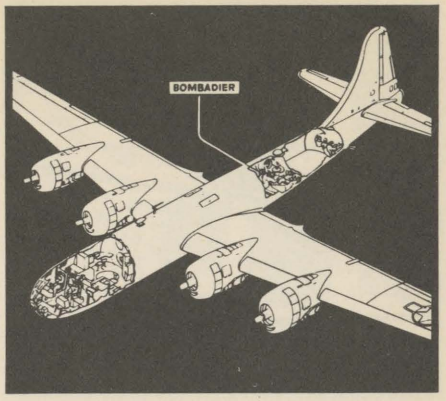
Destroy the BOMB SIGHT with several shots from your service revolver.



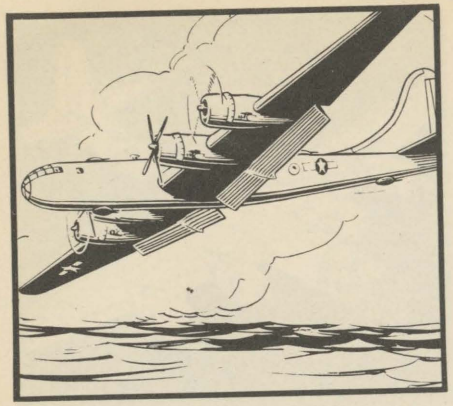
When so ordered by the pilot, CLOSE the BOMB BAY DOORS.

Go to your ditching station when ordered by the pilot.

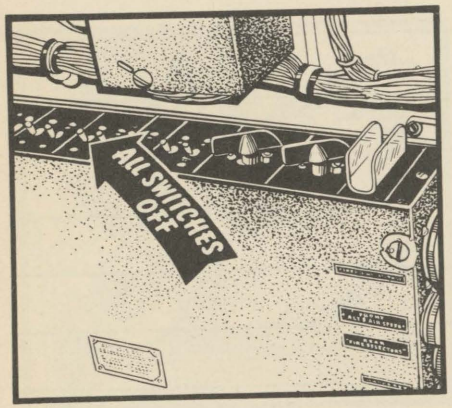
SEE PAGE 377



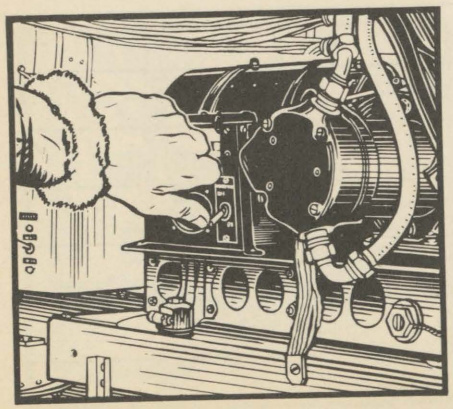
NOTES:



Stow all turrets in the proper position for landing.



All gunners except the top and left gunners will turn their TURRET switches to the OFF position.

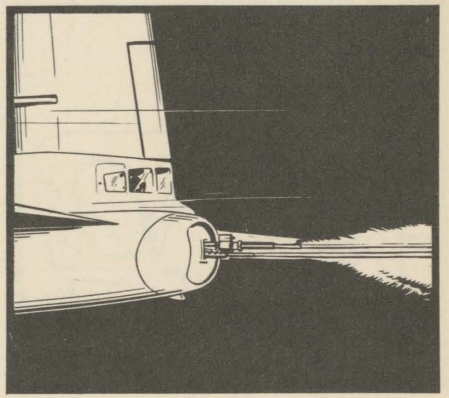


The gun commander will have the AUXILIARY POWER PLANT started when so ordered by the flight engineer.

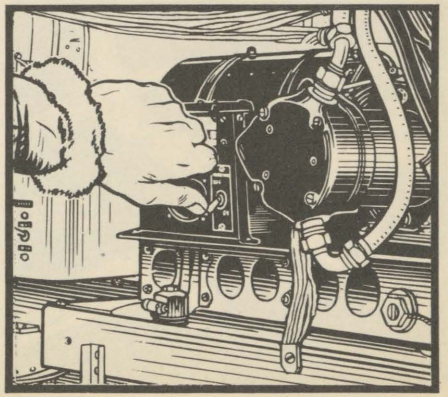
The tail gunner will open his escape hatch and jettison all disposable equipment and close the escape hatch.



The top and left gunners will shoot out the ammunition upon order from the gun commander. The left gunner will remain at his station to receive and relay the pilot's instructions.

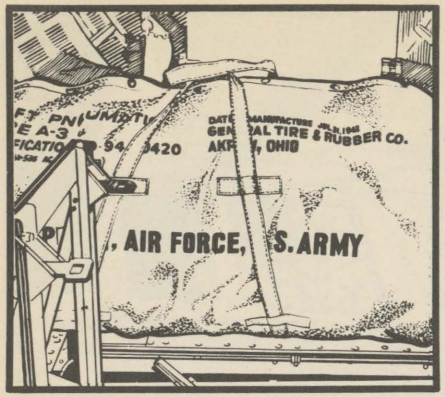


The tail gunner will open the escape hatch aft of the aft pressurized compartment and start the auxiliary power plant upon order from the gun commander.



PREPARATION FOR DITCHING

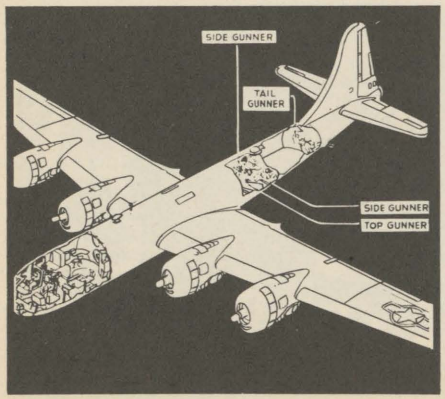
GUNNERS



The gun commander will place the portable dinghy near the escape hatch.



The right side gunner will see that the dinghy ration box is placed near the escape hatch and will close the armament door.



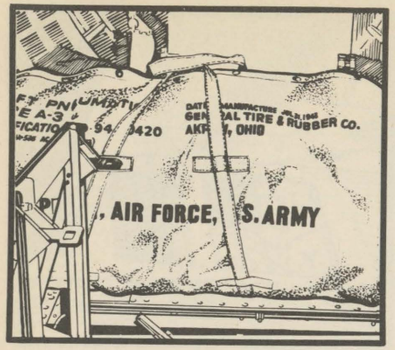
All gunners will go to their ditching stations when so ordered by the pilot.

SEE PAGE 377

LIFT FOR CREW DITCHING POSITIONS (Page 377)

PREPARATION FOR DITCHING

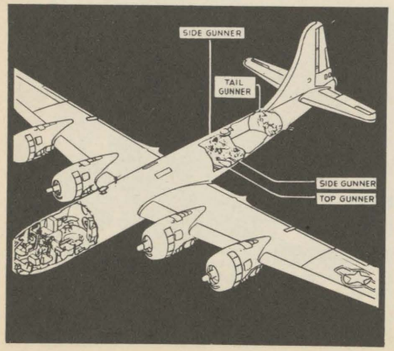
GUNNERS



The gun commander will place the portable dinghy near the escape hatch.

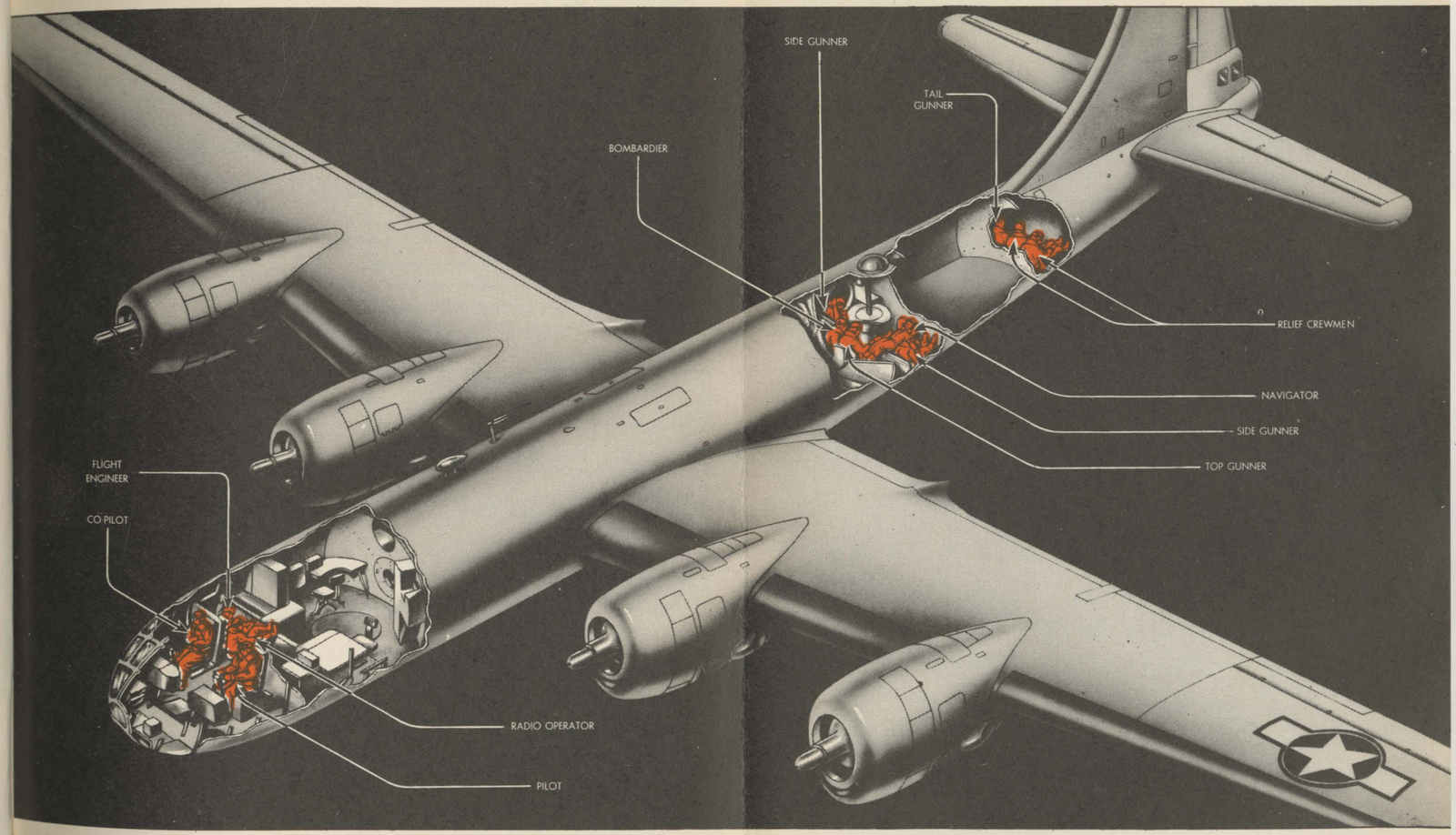


The right side gunner will see that the dinghy ration box is placed near the escape hatch and will close the armament door.



All gunners will go to their ditching stations when so ordered by the pilot.

SEE PAGE 377

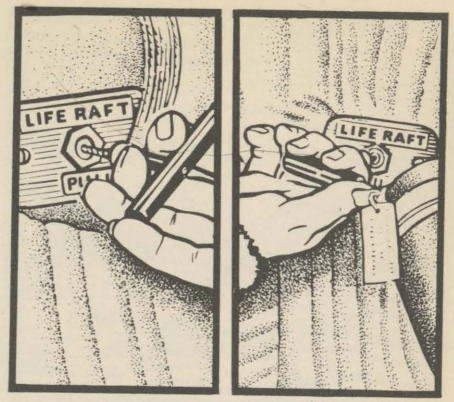


CREW DITCHING POSITIONS

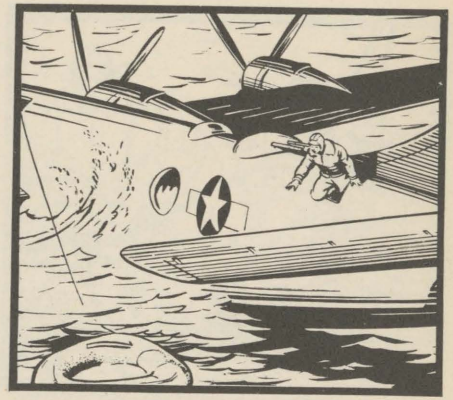
NOTES:

PROCEDURE WHEN THE AIRPLANE IS DITCHED

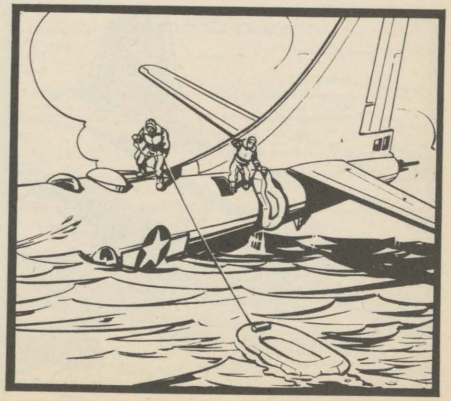
The radio operator will pull the LIFE RAFT RELEASE handles to release the dinghies after the airplane comes to rest. Do not grip the release handles before or during ditching.

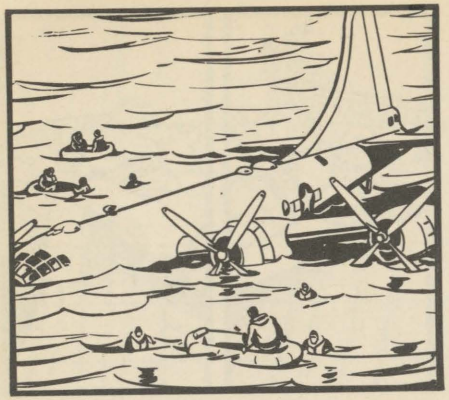


The first man out of each pressurized compartment will retrieve the dinghies.

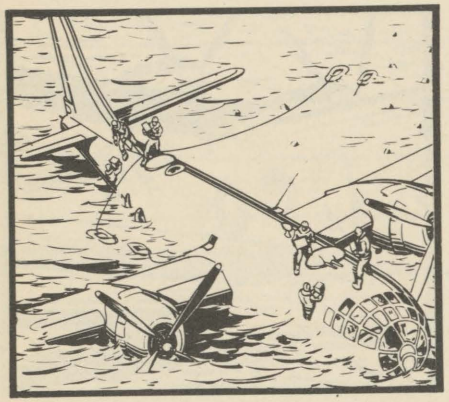


The second man out of each pressurized compartment will inflate and drop the portable dinghy which will be passed to him from inside the airplane.

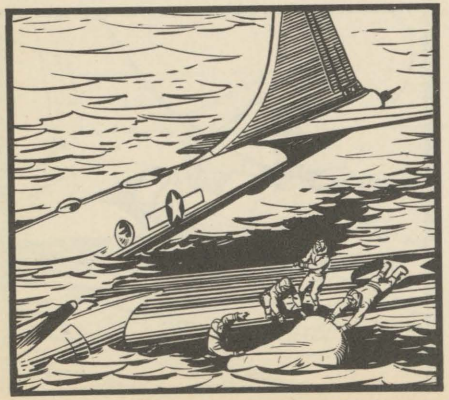




The crew members will inflate their "MAE WESTS" after emerging from their escape hatches. Do not block the emergency exit to look for the dinghies.



Each crew member will be responsible for his own emergency equipment and will see that it gets into the dinghy. If time is limited, throw equipment out of the airplane and retrieve it later.



If a dinghy should become inflated while in an inverted position, try to right it from the wing of the airplane. Do not jump on an inverted dinghy to turn it over, since this expels air from beneath it and makes righting more difficult.

DO NOT remove your clothes, even if they are wet.



Check the dinghy for leaks. Repair any leaks with leak stoppers or patching materials which are placed in the dinghy pockets.



NOTES:

ABOARD THE LIFE RAFT

The crew must be prepared to remain at sea for at least six days. Nothing should be issued during the first 24 hours. After that, give equal amounts to last the six days or longer. Issue half the daily ration (food and water) morning and evening; food should be issued before water. As a receptacle for the storage of rain water, keep every empty tin, making a large hole in its top. Drink all excess rainwater only after storage receptacles are full.

For the preservation of life, water is much more valuable than food. It is of the greatest importance that all available drinking water reaches the life raft and that care is taken to avoid any loss. Men can live only a few days without water, but can survive six weeks or longer without food.

The chewing gum which is provided encourages the flow of saliva into the mouth, keeps it moist, and prevents the mouth from becoming sore. Do not use it until the fourth day, and then ration it to give equal amounts for six days.

The use of alcohol by those who are exposed to severe cold and wet conditions increases the dangers of such exposure. Liquor should not be carried for use in life rafts.

SEA SICKNESS

Most men become seasick in a life raft. The condition generally improves within 24 to 48 hours. Do not eat or drink anything until seasickness stops.

IMMERSION FOOT

A common condition occurring in life rafts is immersion foot. It is characterized by a swelling of the feet and a purplish discoloration, followed later by whiteness and numbness of the skin. It can be prevented by exercising the muscles of the legs and feet, elevating the feet and supporting them at hip level for 30 minute periods as often as is practicable or possible, and by gentle massage, rubbing the skin from the toes toward the feet and then towards the thigh. These procedures aid circulation and help prevent immersion foot.

SEA WATER

Sea water contains a strong solution of salt; it irritates the stomach, causes vomiting and therefore should NEVER be drunk. When the temperature is warm or moderate, bathing of the exposed portions of the body in sea water is generally freshening. To minimize the effects of exposure, all clothing, especially footwear, should be kept as dry as possible.

WOUNDS

A firm bandage holding a clean dressing in position is all that is required on wounds. This is generally sufficient to stop bleeding. Sea water is not harmful to wounds.

PROPELLER FEATHERING INSTRUCTIONS

PILOT AND CO-PILOT

PRACTICE

Reduce the governor setting to a minimum.

Push the feathering button.

Close the throttle.

Shut the fuel OFF.

When the button pops out and the engine stops, turn the ignition OFF.

EMERGENCY

Push the feathering button.

Close the throttle.

Shut the fuel OFF.

When the button pops out and the engine stops, turn the ignition OFF.

UNFEATHERING

See that the governor is in the minimum rpm position.

Open the fuel valve.

Turn the ignition ON.

Depress the feathering button and hold it in until the engine rpm reaches about 600 (but not over 1000); then release.

After the engine warms up, increase the governor setting.

EMERGENCY LANDING GEAR OPERATION

Set the LANDING GEAR POWER TRANSFER toggle switch (on the pilot's control stand) to the EMERGENCY position. This will connect the airplane's NORMAL circuit to the EMERGENCY LANDING GEAR RETRACTING MOTORS. The EMERGENCY CIRCUIT switch on the battery solenoid shield connects the AUXILIARY POWER PLANT and the BATTERY to the EMERGENCY circuit. Either or both of these switches must be set at EMERGENCY if it is desired to use the emergency landing gear motors.

Pull the "T" handle to open the nacelle doors. The initial travel of the handle releases the nacelle doors, full travel operates a momentary switch which causes the nose wheel, left main landing gear, and right main landing gear to lower successively. The "T" handle must be held pulled out until the lowering operation is complete (about 3 minutes). Check to see that the landing gear is extended.

The emergency motors may be used to retract the landing gear but no emergency means are provided for retraction of the nacelle doors.

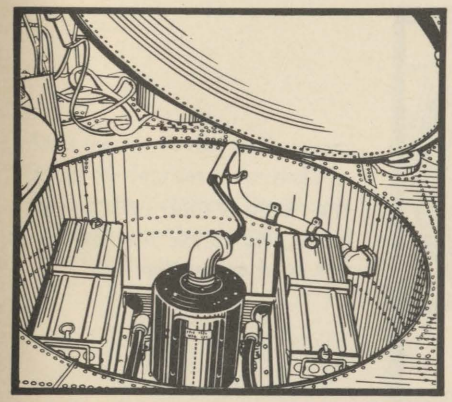
EMERGENCY PORTABLE RETRACTING MOTOR

The airplane is provided with a portable electric retracting motor which is normally stowed in the wing flap operating position. This motor can be used in an emergency to lower and retract the wing flaps and to open and close the bomb bay doors. To use the motor, fasten it to the proper drive and plug the electric wire into the outlet provided. Set the switch on the motor to either the UP or DOWN position as desired. (A switch plate on the motor designates the proper switch positions for bomb bay door and wing flap operation.) NOTE: The emergency landing gear circuit must be energized as described under EMERGENCY LANDING GEAR OPERATION.

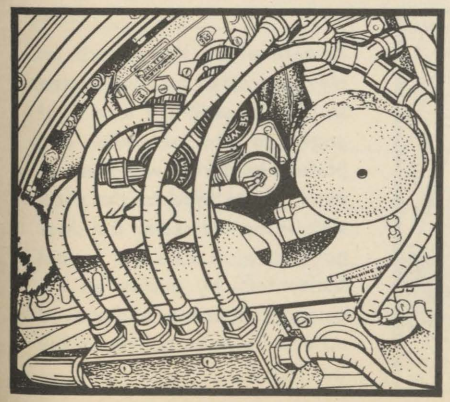
EMERGENCY OPERATION OF LOWER FORWARD GUN TURRET

In case of failure of the electrical system caused by battle damage or other means, the lower forward gun turret may be stalled with the guns pointing forward and horizontal. In this position, the nose wheel doors cannot be opened because the ends of the gun barrels project beyond the door opening.

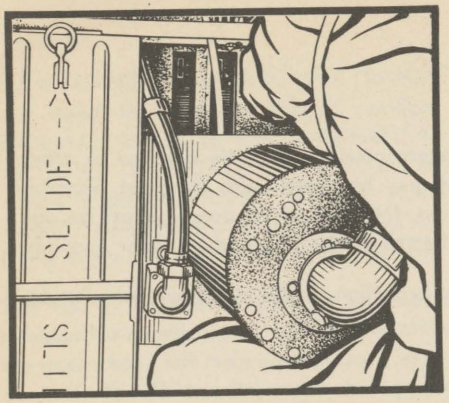
If this happens, the following emergency action should be taken immediately:



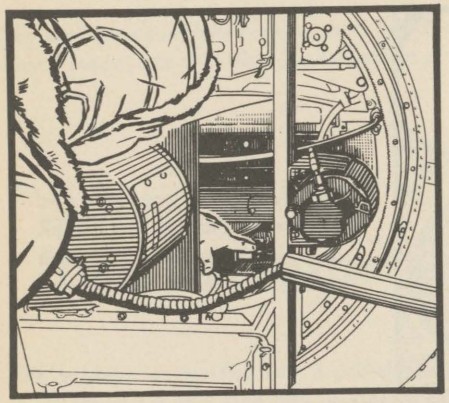
Release cabin pressure and remove the PRESSURE COVER over the turret well. This will expose the turret mechanism.



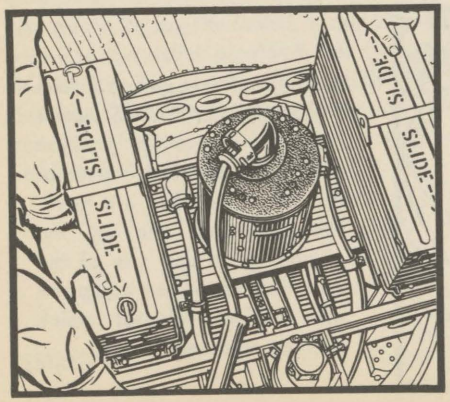
Each turret is equipped with SOLENOID LATCHES which hold the turret in position against the airstream whenever the action switches are open. These latches, one on the azimuth drive and one of the elevation drive, are equipped with manual releases which must be released.



The AZIMUTH LATCH is reached by inserting your hand past the inner side of the right hand ammunition box through a hole in the turret casting. The latch is inside this hole just below the slide rod of the contour follower.

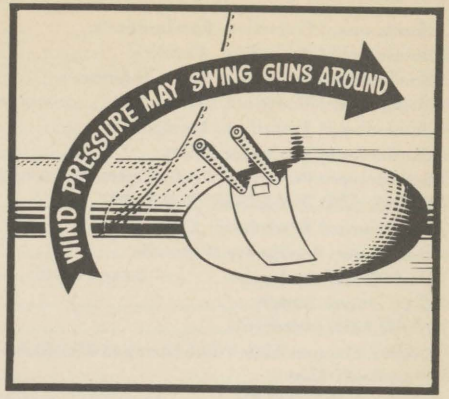


The ELEVATION LATCH is below and to the rear of the left hand ammunition box.

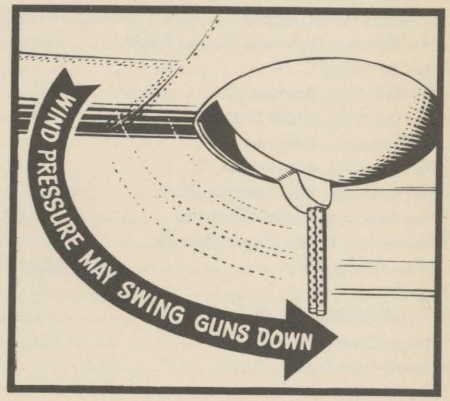


Release either the azimuth or elevation latch by moving the small lever until it is at a right angle to the solenoid end plate. The turret will then be swung down wind by the pressure of the airstream. If it does not move, it can be turned horizontally by pulling on the ammunition boxes, and moved up and down by pulling on the gun butts.

CAUTION: The force of the airstream may cause the turret to swing while the latches are being released. Therefore, hold the guns firmly until the latches are fully released.



Turn the turret to 180 degrees aft or 90 degrees down and re-engage the latches. The turret will then be clear of the nose wheel door.



NOTES:

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